CHARLES UNIVERSITY IN PRAGUE

Faculty of Science

Department of Demography and Geodemography

MASTER THESIS

Prague 2011 **Maxat Kulzhanbekov**

CHARLES UNIVERSITY IN PRAGUE

Faculty of Science

Department of Demography and Geodemography

DEVELOPMENT OF LUNG CANCER MORTALITY IN THE EUROPEAN UNION FROM 1980 TO 2006

Master Thesis

Maxat Kulzhanbekov

Prague 2011

Thesis Supervisor: RNDr. Boris Burcin, PhD.

I declare that this thesis is my own work under the supervision of RNDr. Boris Burcin, PhD. Where other sources of information have been used, they have been acknowledged.

I agree that if any results gained while working on this thesis will be used outside the Charles University in Prague, written permission of the University will be necessary.

I agree to lend this thesis for study reasons and agree that the thesis will be added to the borrower's database.

In Prague Maxat Kulzhanbekov

Acknowledgements

This diploma thesis would not have been possible without help of many people within the Department of Demography and Geodemography of the Charles University in Prague.

First of all, I would like to express my deepest gratitude to RNRr. Boris Burcin for his agreement on being my supervisor. His helpful and critical comments of the thesis helped to find my way. I greatly appreciated your invaluable tutorials and patience. Many thanks!

My special words of appreciation go to RNDr. Tomáš Kučera for his academic and scientific support that kept me going during hard time.

For their kind words of encouragement and spiritual support I thank my parents and brother very much. Also, many thanks to my friends and classmates, for their kindness and cheerful support!

Finally, I wish to express my exceptional gratitude to the President of the Republic of Kazakhstan N.A. Nazarbayev and the International scholarship "Bolashak" for giving me the opportunity to obtain a high standard of education at the Charles University in Prague.

Development of lung cancer mortality in the European Union from 1980 to 2006

Abstract

This master thesis is devoted to study development of lung cancer mortality in the European Union from 1980 to 2006. Through the past two decades cancer was significantly increasing cause of mortality and major public health problem in Europe. Lung cancer remains the most frequent cause of deaths among other form of malignant neoplasms. Mortality development from lung cancer and other malignant neoplasms significantly differentiated between Western and former communist countries of Europe. Over the last two decades lung cancer mortality substantially reduced among males, while in females it was rapidly increasing. Elderly people over age 65 are the most numerous populations suffering from lung cancer. Everyone knows that tobacco smoking is major risk factor which contributes to lung cancer, but nevertheless, people continue to smoke. Despite the measures taken against tobacco, smoking prevalence remains high in the various countries of the European Union.

Keywords: The European Union, malignant neoplasms, lung cancer

CONTENTS

List of abbreviations …… 7

List of tables …… 8

List of figures…… 9

1 Introduction 11
1.1 Problem definition …… 11
1.2 Research goal and objectives …….. 12
1.3 Relevance of the study ……. 12
1.4 Structure of the thesis …….. 13

2 Literature review 14
2.1 Overview of the literature……. 14
2.2 History and description of disease……. … 17
2.3 What do we know about lung cancer…….. 18

3 Theoretical and conceptual framework 20
3.1 Basic concepts……. 20
3.2 Relevant theories and facts …… ……. 21

4 Research questions and hypotheses 24
4.1 Research questions…… 24
4.2 Initial hypotheses…….. 25

5 Data sources and methods 26
5.1 Data sources…… 26
5.2 Methods used……..... 28
5.2.1 Direct method of standardization…… 28
5.2.2 Cluster analysis…… 29

6 Risk factors and prevention measures 32
6.1 Risk factors…… 32
6.1.1 Smoking…… 32
6.1.2 Tobacco consumption……... 33
6.1.3 Passive smoking……..... 38
6.1.4 Asbestos fiber……... 38
6.1.5 Radon……... 39
6.1.6 Occupational factors……..... 39
6.1.7 Air pollution…….. 39
6.1.8 Genetic predisposition…….. 40
6.2 Prevention……... 40
6.3 European policy against tobacco smoking…… 41
6.4 European policy against cancer…… 43

7 Mortality patterns 45
7.1 Mortality trends by the most important causes of death……. 45
7.2 Malignant neoplasms within mortality development…….. 58
7.3 Mortality from the most frequent malignant neoplasms……. 68
7.4 Lung cancer within mortality development.…… 73
7.5 Age and sex distribution by lung cancer mortality……. 83
7.6 Hierarchical cluster analysis of mortality patterns caused by lung cancer……... 92
8 Conclusion 97
References…….. 101
Appendices…….. 104

LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ASDR	Age-Specific Death Rate
BMC	Bio-Medical Center
CVD	Cardiovascular Diseases
CSD	Circulatory System Disease
ECPC	European Cancer Patient Coalition
EU	European Union
FACE	Forum Against Cancer Europe
ICD	International Classifications of Diseases
IUAC	International Union Against Cancer
HIV	Human Immunodeficiency Virus
MN	Malignant Neoplasms
PMI	Project Management Institute
SHS	Second Hand Smoke
SPSS	Statistical Package for the Social Sciences
SDR	Standardized Death Rate
UK	United Kingdom
UNDP	United Nations Development Programme
US	United States
WHO	World Health Organization

LIST OF TABLES

Tab.1 List of selected countries of the European Union according to available years…… 26

Tab.2 List of causes of death (condensed/detailed) according the revisions of the International Classification of Diseases…… 27

Tab.3 Mortality caused by circulatory diseases in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)……. 46

Tab.4 Mortality caused by malignant neoplasms in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)…….. 47

Tab.5 Mortality caused by other causes of death in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)…….. 48

Tab.6 Mortality caused by all causes of death in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)…… 49

Tab.7 Mortality caused by circulatory diseases in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)……. 52

Tab.8 Mortality caused by malignant neoplasms in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)……. 53

Tab.9 Mortality caused by other causes of death in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)……. 54

Tab.10 Mortality caused by all causes of death in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)……. 55

Tab.11 Mortality caused by malignant neoplasms in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)…….. 59

Tab.12 Mortality caused by malignant neoplasms in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)…….... 60

Tab.13 Mortality caused by lung cancer in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO's European Population Standard)…… 74

Tab.14 Mortality caused by lung cancer in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO's European Population Standard)…… 75

Tab.15 a-f Statistical variation by lung cancer mortality for the period since 1980, 1990-2006, males-females in selected age-groups…… 84

Tab.16 Mortality by age from lung cancer, EU countries, 1980-2006, males…… 88

Tab.17 Mortality by age from lung cancer, EU countries, 1980-2006, females……. 89

LIST OF FIGURES

Fig.1 Prevalence of smoking, EU countries, 15 years old, boys (1989/90, 1993/1994, 1997/98 and 2001/02) …… 34
Fig.2 Prevalence of smoking, EU countries, 15 years old, girls (1989/90, 1993/94, 1997/98 and 2001/02) 35
Fig.3 Prevalence of smoking, EU countries, according to sex, adults aged 15 and over, latest available years…… 36
Fig.4 Number of cigarettes consumed per person per year, EU countries, according to the sex, selected years……. 37
Fig. 5 Mortality caused by neoplasms and circulatory diseases, EU countries, 1980, males, standardized death rates (per 100 000 persons WHO European Population Standard)…….. 50
Fig. 6 Mortality caused by neoplasms and circulatory diseases, EU countries, 1990, males, standardized death rates (per 100,000 persons WHO European Population Standard)…….. 50
Fig. 7 Mortality caused by neoplasms and circulatory diseases, EU countries, 2006, males, standardized death rates (per 100, 000 persons WHO European Population Standard)……. 51
Fig. 8 Mortality caused by neoplasms and circulatory diseases, EU countries, 1980, females, standardized death rates (per 100,000 persons WHO European Population Standard)…….. 56
Fig. 9 Mortality caused by neoplasms and circulatory diseases, EU countries, 1990, females, standardized death rates (per 100,000 persons WHO European Population Standard)…….. 56
Fig.10 Mortality caused by neoplasms and circulatory diseases, EU countries, 2006, females, standardized death rates (per 100,000 persons WHO European Population Standard)…….. 57
Fig.11 Mortality caused by malignant neoplasms, Western European countries, 1980-2006, males, standardized death rates (per 100, 000 persons, WHO European Population Standard) …….. 61
Fig.12 Mortality caused by malignant neoplasms, post-communist European countries, 1980-2006, males, standardized death rates (per 100, 000 persons, WHO European Population Standard) …… 62
Fig.13 Mortality caused by malignant neoplasms, Western European countries, 1980-2006, females, standardized death rates (per 100, 000 persons, WHO European Population Standard)…… 63
Fig.14 Mortality caused by malignant neoplasms, post-communist European countries, 1980-2006, females, standardized death rates (per 100, 000 persons, WHO European Population Standard)…….. 64
Fig.15 Index of mortality changes caused by malignant neoplasms, Western European countries, 1980-2006, males and females…….. 66
Fig.16 Index of mortality changes caused by malignant neoplasms, post-communist European countries, 1980-2006, males and females……. 67
Fig.17 Mortality from the most frequent malignant neoplasms, EU countries, 1980, males, standardized death rates (per 100, 000 persons, WHO European Population Standard)…… 69
Fig.18 Mortality from the most frequent malignant neoplasms, EU countries, 1990, males, 69

standardized death rates (per 100, 000 persons, WHO European Population Standard)……
Fig.19 Mortality from the most frequent malignant neoplasms, EU countries, 2006, males, standardized death rates (per 100, 000 persons, WHO European Population Standard)……. 70
Fig.20 Mortality from the most frequent malignant neoplasms, EU countries, 1980, females, standardized death rates (per 100, 000 persons, WHO European Population Standard)……. 71
Fig.21 Mortality from the most frequent malignant neoplasms, EU countries, 1990, females, standardized death rates (per 100, 000 persons, WHO European Population Standard)…… 72
Fig.22 Mortality from the most frequent malignant neoplasms, EU countries, 2006, females, standardized death rates (per 100, 000 persons, WHO European Population Standard)……. 72
Fig.23 Mortality caused by lung cancer, Western European countries, 1980-2006, males, standardized death rates (per 100, 000 persons, WHO European Population Standard)…… 76
Fig.24 Mortality caused by lung cancer, post-communist European countries, 1980-2006, males, standardized death rates (per 100, 000 persons, WHO European Population Standard) 77
Fig.25 Mortality caused by lung cancer, Western European countries, 1980-2006, females, standardized death rates (per 100, 000 persons, WHO European Population Standard)…… 78
Fig.26 Mortality caused by lung cancer, post-communist European countries, 1980-2006, females, standardized death rates (per 100, 000 persons, WHO European Population Standard) …… 79
Fig.27 Index of mortality changes caused by lung cancer, Western European countries, 1980-2006, males and females……. 81
Fig.28 Index of mortality changes caused by lung cancer, post-communist European countries, 1980-2006, males and females…… 82
Fig.29 Mortality by age from lung cancer, EU countries, 1980, males……. 86
Fig.30 Mortality by age from lung cancer, EU countries, 1990, males…… 86
Fig.31 Mortality by age from lung cancer, EU countries, 2006, males…… 90
Fig.32 Mortality by age from lung cancer, EU countries, 1980, females……. 90
Fig.33 Mortality by age from lung cancer, EU countries, 1990, females……. 91
Fig.34 Mortality by age from lung cancer, EU countries, 2006, females…….. 94
Fig.35 Mortality caused by lung cancer, grouping the EU countries in selected years, males…….. 93
Fig.36 Index of mortality change caused by lung cancer, grouping the EU countries in selected years, males……. 94
Fig.37 Mortality caused by lung cancer, grouping the EU countries in selected years, females…... 95
Fig.38 Index of mortality changes caused by lung cancer, grouping the EU countries in selected years, females……. 96

Chapter 1

Introduction

1.1 Problem definition

The diseases which were widely spread in ancient times and in the middle ages, nowadays are rare and almost do not exist in developed countries (For instance: plague, cholera, typhus etc). However, there are some of them which in turn were widely spread in certain periods and became a serious problem for a variety of countries nowadays, such as malignant neoplasms.

The Union for International Cancer Control states that: “Every year in Europe, cancer kills about 2 million people and more than 3 million new cases appear. Almost 6 million people are currently living with cancer. Cancer mostly appears in prostrate and lung within men and in woman’s breast. It can also appear in colon and rectum in both cases. Cancer is responsible for more than one death in four. Tobacco, diet and infections causes more than 40% of cancer deaths in Europe.” (A. Anderson et al. 2004:16).

In addition to that: “Lung cancer is one of the most hazardous threats that increase mortality risks in population of Europe, as for several decades lung cancer continues to be the main factor of males’ mortality in Europe, approximately 280 thousand deaths per year. Moreover, colorectal cancer causes nearly 98 thousand deaths per annum” (Tyczinski et al. 2004:599).

Lung cancer is considered to be the most problematic disease which still hugely affects the health of European population. It is well known fact that smoking is the key reason for lung cancer. Nevertheless, people are continuing smoking. The last decades show that cancer was mainly caused by tobacco smoking and unhealthy lifestyle. The proportion of elderly population is also increasing which in turn may result in doubling the number of new cases by 2020, particularly in Southern and Eastern Europe.

According the estimates (1995), 90% of men’ and 60% of women’ lung cancer mortality were caused by tobacco smoking in the European Union. Estimated results could already been considered as an epidemic. If in the first half of 20th century features of epidemic were observed within males only (because it was rarely spread among women), while in the second half of the 20th century, smoking habits increased among women living in Northern Europe, spreading furthermore to Southern and Eastern Europe. (Bray, Tyczynski and Parkin 2004:96).

Rapid increase of lung disease negatively affects economic burden of European working age population. It influences the life expectancy of people and has features of epidemiologic misery. Hence, tobacco smoking ceased to be solely the medical problem. It has been widely studied among various non-medical specialists as well. Intensive pace of industry development negatively affects to the eco-biological system of the European countries. Therefore, population of European countries is facing today very complicated and at the same time concrete task of struggling lung cancer (Palmer 1986:297).

This problem can not be solved by total eradication of lung cancer; however it can be solved by the decrease or stagnation of the lung cancer development.

1.2 Research goal and objectives

The aim of the diploma thesis compiles from gathering comprehensive data and analysis of data about the trends of lung cancer mortality within the European Union. For the detailed research of lung cancer mortality, we have chosen 24 countries of the European Union for the period from 1980 to 2006. Hence the following objectives are relevant:

- To identify the level of lung cancer mortality among the European Union countries;
- To analyze lung cancer mortality by sex differentiation among the European Union countries;
- To provide descriptive analysis for the causes leading to the growth and spread of lung cancer mortality;
- To describe in detail what kind of measures are taken by the European Union to maintain and stagnate lethal cases caused by lung cancer.

1.3 Relevance of this study

The importance or relevance of this work is that many European countries consider lung cancer mortality as one of the crucial social diseases nowadays. Tobacco consumption is the main factor of mortality risk in lung cancer development. In 90% of cases of lung cancer mortality of men and 60% cases of women are related to tobacco smoking, hence contemporary societies challenge this as a sharp problem and struggles with tobacco smoking (Simonato et al. 2004:886). In particular, massive spread of tobacco smoking has involved young age groups into this problem. Bad habits affects negatively to the society in general and personal living conditions. At the moment it has become global scale problem. The main factors of such wide-spreading of this bad habit are low price for tobacco, wide access and lack of restrictions in legislation regarding the advertisement of tobacco based production. Lung cancer is malignant neoplasm disease which is clearly proved to be caused by tobacco smoking. In early 50’s it was determined that smoking, especially cigarettes are among the most spread cause of lung cancer. The incidence of lung disease among women (whose smoking habits were not generally so frequent and lagged men’s smoking till the end of the Second World War and after war period) is increasing especially in higher age groups (Blaine and Reed 1994:536).

It should be noted that the increase of malignant neoplasms of the lung is directly related to cigarette consumption and the number of smokers. Until society does not take steps to minimize

exposure to carcinogenic substances in the form of tobacco and other risk factors, lung cancer will remain the most significant and serious demographic problem in the European Union. It concerns not only Europe, but all other continents as well. Therefore, relevance of this study cannot be underestimated.

1.4 Structure of the thesis

Structure of the thesis consists of seven chapters. The first chapter explains the main problems, goals and objectives as well as the importance of thesis. The second chapter focuses on reviewing relevant literature, which describes in details the importance of thesis. The second chapter covers description and development of lung cancer from historical point of view. The third chapter describes the theory of the "Epidemiological transition", defining its terminology, basic facts and development stages. The first three chapters cover theoretical part of the thesis. The forth chapter deals with research questions and also stipulates the research hypotheses. The main issue to be covered is to explain to what extent lung cancer mortality will intensify and what human beings will do with this degenerative man-made disease (e.g. tobacco smoking). The fifth chapter describes the quality and accessibility of data on mortality from lung cancer and all malignancies. In addition, this chapter focuses in detail on all the basic methods of calculating, under which research was conducted. Reliability assessment is also under scope of this study. The sixth chapter covers major risk factors of lung cancer and prevention measures. The final chapter is divided into six broad analyses parts. The first two parts examines the overall mortality from circulatory diseases and malignant neoplasms. The third part widely explains gender differences in mortality development from the most frequent form of malignant neoplasms. The forth part describes development of lung cancer mortality. The fifth part illustrates the gender differences in the selected age-groups caused by lung cancer mortality. The sixth part is devoted to cluster analysis which allows identifying groups of countries in terms of lung cancer mortality. In the conclusion of the thesis the main findings are recapitulated and discussed.

Chapter 2

Literature review

2.1. Overview of the literature

Investigation of deaths from malignant neoplasms in the European Union remains a major and polemic topic. Over the past two decades a lot of studies have been conducted and many scientific articles are written about the situation of mortality from lung cancer. Demographers of many European countries continue to discuss them in “hot disputes”. Lots of interesting works were written on theme of mortality from lung cancer in modern literature.

The scientific article “Lung cancer mortality patterns in selected Central, Eastern and Southern European countries” which published in 2004 is another source to be retrieved. Such authors like Jerzy E. Tyczynski, Freddie Bray, Tiiu Aareleid, Miriam Dalmas, Juozas Kurtinaitis, Ivan Plesko, Vera Pompe-Kirn, Aivars Stengrevics and D. Maxwell Parkin addressed the problem of the significant impact of tobacco on the health of European citizens. Through comparative analysis, they attempted to identify significant differences in mortality patterns among men and women. Age-standardized mortality rates were calculated for all ages combined and for age groups 20-34, 35-44, 45-54, 55-64, 65-74 and 75 and over. A joint-point regression analysis was established to ensure the calculation of the annual percentages and to identify the time trends where significant changes are occurred. According to obtained results the largest proportion of lung cancer mortality among males was recorded in Poland and Cyprus (34.6% and 33.2%, respectively), while the lowest proportion was in Slovakia (27.6%) and Slovenia (27.3%). Mortality rates was extremely high in Hungary (ASMR = 86.2 deaths 100 000 persons) and Poland (ASMR =71.5 deaths per 100 000 persons), whereas in Malta it considered low (ASR 45.9/100.000 persons). In Cyprus lung cancer was the second most common cause of death among neoplasms (after breast cancer), while in the Czech Republic, Hungary, Poland, Slovakia and Slovenia lung cancer was remained the third common type of neoplasm after breast and colorectal cancer. The highest proportion of lung cancer deaths were recorded in Hungary (12.8%) and Poland (10.1%) and the lowest proportion are found in Malta (4.6%) and Lithuania (6.4%). One of the highest mortality rates among women was considered in Hungary (ASMR=20.0 deaths per 100 000 women), the Czech Republic (ASMR=11.5 deaths per 100 000 women) and Poland (ASMR=11.3 deaths per 100.000 women), whereas the lowest remained in

Malta (ASMR=4.8 deaths per 100 000 women) and Lithuania (ASMR=5.5 deaths per 100 000 women). The authors emphasized that cigarette smoking among young people continues to increase. In West Europe around 2/3 of smokers begin smoking before the age of 18 and 1/3 before the age of 16. Cigarette smoking was prevailing not only in candidate states, but also among EU member states (for example Germany and Spain). The authors suggest that carcinogenic substances which contained in tobacco smoke are the most dangerous, that lead to cancer of the lungs, therefore, cessation of tobacco smoking is the best way to avoid getting lung cancer. In this regard, they suppose that lung cancer mortality can be reduced only through effective tobacco control policies and preventive measures (for example screening) that will help to identify disease at early stages.

Published in 2007 by Oxford University press the article "Convergence of male and female lung cancer mortality at younger ages in the European Union and Russia" is devoted to lung cancer mortality and tobacco smoking epidemic which the most serious single public health problem in Europe. In this paper authors (Witold Zatonski, Marta Manczuk, John Powles and Eva Negri) discuss the gender differences in mortality development from lung cancer and the most important causes contributing to the emergence of this disease. For comprehensive investigation they selected 15 EU countries (mainly from Western countries) and the ten new EU members in Central and Eastern Europe plus Russia (as a country belonging to the Eastern Europe). The age-standardized mortality rate was used to estimate lung cancer mortality at ages between 20 to 44 years, which were obtained separately for 26 countries. According to obtained results lung cancer mortality among men and women significantly decreased in France and the Netherlands. Also, mortality patterns of the male population substantially reduced in Bulgaria, Russia, Poland, Slovakia, Czech Republic, Hungary, Austria, Germany, Luxembourg, Denmark, Sweden, Ireland, Greece, and the Baltic States. The most striking example is the United Kingdom, mortality significantly decreased in both sexes. Portugal was the only country where the smoking epidemic was significantly high among both sexes. In Sweden, mortality from lung cancer remained high among men aged over 65 years. Authors suggest the necessity of establishing valid and effective monitoring system for smoking prevalence. However, the most constitutive way is to implement effective tobacco control measures to stop and reverse the increasing trend in tobacco smoking among young people in Europe.

The article "Lung cancer mortality trends in 36 European countries: secular trends and birth cohort patterns by sex and region 1970-2007" which published in 2009, based on the main cause of lung cancer - smoking. Freddy lan Bray and Elisabete Weiderpass describe recent temporal patterns of lung cancer mortality in the European region as well as structural differences by sex and age. To achieve comprehensive result an aggregated age-specific and age-standardized rates were calculated. According to geographical variations, lung cancer mortality was significantly differentiated among European countries. The highest rate was recorded in Hungary, while the lowest in Nordic countries (e.g. Sweden). Lung cancer mortality rates among females considered high in Denmark and Iceland. In the mid of 1990th mortality patterns of the female population significantly increased in Eastern Europe. Substantial decline of the male mortality was recorded in the Czech Republic and Ukraine. Initially, mortality from lung cancer was the lowest in Romania, but over the last decade considered to increase. In contrast to males, mortality development among females was significantly high in Hungary, Bulgaria and the Czech Republic. Lung cancer mortality was the most frequent in the age-group 20-44. Mortality patterns from lung cancer were rapidly increasing in France, the Netherlands

and Spain. The authors assumed that the generation of women born between 1900 and 1960, are the most vulnerable to lung cancer. Significant differences in lung cancer mortality among neighboring countries are largely depended on smoking level. Authors emphasized, that prevalence of smoking in women is one fourth that of men. Among teenagers smoking prevalence is about one fourth of all smokers. According to the WHO estimates, in the 20th century, smoking killed about 100 million people, if appropriate measures against anti-tobacco activities will not be taken in 21st century it probably could kill one billion people. Researchers hope that the WHO's program MPOWER undertaken in 2008 against tobacco smoking, will in turn prevent the increase in mortality from lung cancer in forthcoming decade.

The medical article "Lung cancer in the elderly – increasing epidemiological problem of the 21st century" which published in 2005 in co-operation with Batura-Gabryel and Foremska-Iciek, focused on seniors (65 year old) who are the most numerous population suffering from lung cancer. Article describes that risk of morbidity and mortality increases with the aging process. Researchers conclude that the risk of death among cigarette smokers is much higher (33 times) than in none smokers. Facts represent that screening programs and medical treatments in the early stages of clinical advance make it possible to avoid surgical intrusion. The cause of many adverse outcomes of treatment of lung cancer among the elderly is a consequence of late diagnosis of the disease. Researchers believe that the treatment of elderly people depends on the stage of disease. The authors believe that lung cancer mortality can be significantly reduced through the implementation of preventive measures such as non-smoking, healthy lifestyles and timely diagnosis, which in turn will treat and even eliminate the disease.

Published in 2010 by the European Union in the framework of the Public Health Program the article "Determinants of smoking initiation among women in five European countries: a cross sectional survey" is devoted to women's smoking tendency. The main goal of the authors (D. L. Oh, J. E. Heck, C. Dresler, S. Allwright, M. Haglund, S. S. Del Mazo, E. Kralikova, I. Stucker, E. Tamang, E. R Gritz and M. Hashibe1) is to determine why women start smoking and what factors may contribute to this. To achieve a comprehensive results and within program "Women in Europe against lung cancer and smoking" (WELAS) Project cross-sectional survey was applied. A total 5,000 adult women from France, Ireland, Italy, Czech Republic, and Sweden were interviewed, with 1,000 from each participating country. All participants were asked questions concerning demography, views on smoking and tobacco addiction. In addition, current and former smokers were interviewed. Two following methods were used: logistic regression, to analyze ever versus never smokers, and linear regression, to analyze the age of smoking initiation. The results showed, if a family has at least one person (for example: father, mother, uncle or brother) who smokes, this contributes to smoking. In particular, 62.3% of respondents answered that the most frequent reason for smoking was a friend. The average age at which people start smoking was 18.2 years, while 80% started smoking before age 20. Thus, the highest rates of young initiators were recorded in Sweden with 29, 3% who started smoking at the age of 14-15 and 12.0% at age 14. Relatively low level of young smokers was in the Czech Republic with 13.7% of women who began smoking at the age of 14-15 and 1.4% women who started smoking at the age of 14. The researchers concluded that among European women, friends, is the main factor influencing on smoking initiation, especially among young women.

In abovementioned, many researchers argue that one of the most important elements in the study of lung cancer mortality should be given to the problem of tobacco smoking as a major risk factor contributing to the emergence of a malignant tumor.

2.2 History and description of disease

Throughout the existence of the humans, death remains unrepeatable and very sensitive natural phenomenon in society. Mortality as an inevitable process of the human beings has always attracted attention of scientists. The death of any human organism is the result of interaction between the two groups of factors: endogenous, generated by the internal development of the organism, and exogenous associated with the action of the external environment. They are combined differently to each other, exogenous and endogenous factors that shape the lethal case. Within the development of medicine and technologies social control of mortality remarkably increased, society has real prospect to impact on its endogenous factors. In economically developed countries of Europe the priority is to reduce mortality from the influence of exogenous factors, which leaves its imprint on the problem of malignant neoplasm. Many thousands of scientists for hundreds of years have been trying to understand its causes and find ways for its prevention and treatment. What is a malignant neoplasm and how to understand it? To explain this terminology we will attempt to determine what cancer is.

Cancer – is tumors whose features are most often (in contrast to the properties of benign tumors) make it extremely dangerous for life of organism, which gave a reason to call it “malignant”. This can also be characterized as a group of diseases caused by the uncontrolled multiplication of one or more cells that are multiplying in numbers occupying more space and forming a tumor. Each of them affects the man in his essence, irrespective of which body disease appeared initially. Cancer is very complex disease, speaking only by the affected organs. As the nightmare of our time, cancer affects not only the sick directly, but also society as a whole. More than half of patients die, despite the fact of the development of medicine, the number of deaths from cancer is substantially increasing (Kardinal and Yarbro 1979:396).

Cancer affects all nations with no boundaries and restrictions. One of the first sources of existing cancer tumors had found in the fossil bones of the Neolithic times, as well as in the bones of American Indians living in pre-Columbian era. Cancer was first described in an Egyptian papyrus of about 1600 BC In the papyrus several forms of breast cancer are described. It also reports that the disease has no cure. The name "cancer" is derived from the term "carcinoma" which was imposed by Hippocrates (460-370 BC) and signifies the malignant neoplasm with perifocal inflammation (Kardinal and Yarbro 1979:396)

Since the early 20th century, the frequencies of cancer have increased. This is probably due to improved diagnosis, which allowed identifying many cases that previously would have remained undetected. However, another genuine reason is an increase in morbidity due to increasing proportion of older people in the population who likely have cancer more than any other age groups (Andreeva and Krasovski 2004:22).

The dynamics of morbidity and mortality from cancer shows a steady increase of this pathology in many countries. Malignant neoplasms ranked second most common causes of deaths after cardiovascular diseases.

It is significant that in the economically developed countries, cancer is found most often. The explanation to this is better diagnosis and preventive measures as screening or higher proportion of elderly people. Cancer is degenerative disease and most frequently found in people of higher ages. However, there are some types of cancer, which often occurring in young people. On the other hand - even traditional medicine proves that some types of cancer such as lung cancer are uniquely related to living standards and environmental characteristics of our civilization with no respect to age groups. In the context of the intensive growth of cancer worldwide, the society is carrying much effort to identify high-risk neoplasm. The most dangerous among them is lung cancer.

2.3. What do we know about lung cancer?

Lung cancer is a tumor that develops from the epithelium of the affected lung. Despite the qualitative progress of medical technology, mortality from this disease is high. Currently, in developed countries, lung cancer is the most common form of cancer among men and remains the major health and socio-economic problem. The most important factor contributing to the emergence of lung cancer is smoking. As everyone knows, cigarette smoke contains large amounts of carcinogenic substances. Prolonged exposure to carcinogens in long-term leads to a violation of the structure and function of bronchial epithelium, metaplasia of columnar epithelium into stratified squamous and contributes to malignant tumor (Uglov 1959:11)

Until the twentieth century, lung cancer was extremely rare disease. In 1989, the world medical literature reported only 140 cases of this disease (Andreeva et al, 2004). In the early decades of the twentieth century, doctors were eager to look at this type of cancer believing that they might not have another chance to see it again. In 1912 the first survey on this subject has been prepared on the basis of 374 cases of lung cancer. Isaac Adler noted that malignant neoplasm in the lungs is "very rare form of" cancer which progressed in organism rapidly. This was confirmed by European annual conference in 1923 at the German Association of Pathology. Initially, researches had doubts on the accuracy of the diagnosis. At the same time various hypotheses were proposed about the causes of this phenomenon, which included air pollution, vehicle exhaust, the increase in the number of X-ray studies, and even exposure to the action of poisonous gases during World War II (Andreeva and Krasovski 2004:21).

Establishing the link between cigarette smoking and cancer was complicated by a large time interval (20 years or more) between the start of smoking and the appearance of symptoms. Nevertheless in 1912 Adler apparently one of the firsts suggested that cigarettes may be causing the epidemic of lung cancer. In early 1920's many researchers started to express the features of that disease which had associated with tobacco smoking. But the first quantitative analysis supporting this hypothesis was conducted by Doctor Fritz Likint from Dresden who in 1929 showed that patients with lung cancer tended to be smokers. In 1939 a doctor from Cologne, Franz Hermann Muller has the world's first epidemiological study on the relationship of smoking with lung cancer on the principle of case control and concluded that tobacco is the main cause of the epidemic. Studies carried out a little later in Krakow, Vienna, initiated German researchers to believe into the relationship of tobacco smoking with lung cancer as well determined and undisputed (Andreeva and Krasovski 2004:22).

Currently lung cancer is the most commonly diagnosed type of cancer worldwide. Lung cancer is more common in developed countries than in developing countries. This is due to the fact that lung cancer in average develops rather late in higher ages and for its significant prevalence greater life expectancy needed. Prevalence of lung cancer is usually higher among men than in women.

Chapter 3

Theoretical and conceptual framework

3.1. Basic Concepts

Basic concepts and terminology are used from multilingual demographic dictionary (United Nations, 1958), its English version, the World Health Organization, Wikipedia and other official sources.

Master thesis covers the concept of mortality development. **Mortality** is a process of extinction generation consists of many individual deaths and occurring at different ages. It analyzes the mortality (deaths) in both national and regional levels. Medical authorities use mortality statistics for monitoring and improving their performance. Herein the following terminology is given.

Death rate – a number of deaths occurring in a population during a given period of time, as a proportion of number in population. Usually the mortality rate comprises death from all causes and it expressed as death per 1000 persons. A disease caused death (age or sex) is reported as death per 1000 people of the specified time. The mortality rate might be standardized when comparing mortality rates over time, or between countries.

Age standardized mortality rate – is a weighted average of the age specific mortality rates per 100 000 persons, where the weights are the proportions of persons in the corresponding age groups of the WHO standard population.

Cancer – is a class of diseases in which a cell, or group of cells display uncontrolled growth.

Lung cancer – is a disease of uncontrolled cell growth in tissues of the lung. This growth may lead to metastasis. The vast majority of primary lung cancers are carcinomas of the lung, derived from epithelial cells.

Breast cancer - is cancer originating from breast tissue, most commonly from the inner lining of milk ducts or the lobules that supply the ducts with milk.

Bladder cancer refers to any of several types of malignant growths of the urinary bladder. It is a disease in which abnormal cells multiply without control in the bladder.

Stomach cancer - (also called gastric cancer) can develop in any part of the stomach and may spread throughout the stomach and to other organs; particularly the esophagus and the small intestine.

Colorectal cancer - also called colon cancer or large bowel cancer includes cancerous growths in the colon, rectum and appendix. Colorectal cancers arise from adenomatous polyps in the colon.

Prostate cancer - is a form of cancer that develops in the prostate, a gland in the male reproductive system

3.2 Relevant theories and basic facts

Basic principles of epidemiological transition and its relation to the demographic transition was well described by the 20th century demographers such as Omran, Caldwell, Philips[1]. Currently, the concept of epidemiological transition can be considered as the basic theoretical model that explains the change in morbidity and mortality.

Demographic factors of mortality traditionally divided into two groups: endogenous (such as natural aging, inherited diseases, birth defects and other factors due to biological characteristics of the human body and its heredity) and exogenous (related to the influence of the environment: accidents, injuries and poisoning, infectious and parasitic diseases, acute respiratory diseases and digestive system and some others). The theory of epidemiological transition is the attempt to distinguish endogenous and exogenous factors of mortality, which in detail explains trends occurred and are occurring in the evolution of mortality (Demoscope, 2004). Thus, Urlanis[2], who were not among the supporters of the concept of epidemiological transition, in his work "Evolution of life-span" shared factors of mortality by the internal and external causes. Attempts to separate the causes of death in the endogenous and exogenous can be found in several studies of Bourgeois-Pichat[3], where a group of exogenous causes attributed infectious diseases, respiratory diseases and injuries, and to endogenous - all other causes of death (including cardiovascular disease and neoplasms).

Throughout human history there have been great quantitative and qualitative changes in the mode of death. In terms of demographics, these changes can be regarded as one of struggle with premature mortality, an attempt to bring life expectancy to the biological life.

For a few millennia Earth was dominated by so-called traditional type of mortality. Life expectancy in almost all regions did not exceed over 35 years. "The normal mortality rate" is determined by external conditions of the human environment: external causes associated with various adverse natural disasters, violent deaths and all sorts of accidental cases, as well as the high prevalence of various infectious diseases. There was also extraordinary increase in the mortality caused by epidemics (plague, cholera, and smallpox) and hunger, as well as the numerous wars. For the first time the concept of epidemiological transition was launched in 1971 by the American demographer Omran to explain the reasons and regularities of changes in morbidity and mortality by cause in different populations. The very essence of the concept of epidemiological transition is in the approval of a radical change in the structure of mortality by causes, when to change prevalence of exogenous causes of death came to the primacy of endogenous and quasi- endogenous. The beginning

[1]Omran A. R. (1971). “The epidemiologic transition”. Milbank Memorial Fund Quarterly, 49, 1,509 – 538.
(1977) “Epidemiologic transition”. U.S. Population Bulletin. 32.
Caldwell J.C., (2001), Population health in transition. Bull World Health Organ 2001; 79:159–70.
Phillips, D.R. (1994). Health and Development, Routledge, London, 336 pp.
[2] Urlanis B.C. (1978), Evolution of life-span. Publisher: Statistics.
[3]Bourgeois-Pichat, J., (1984),"Mortality Trends in the industrialized countries," Mortality and Health Policy, New York: United Nations.

of this historic shift, the duration of which exceeds a century, experts refer to the mid-nineteenth century, although the first signs of it appeared in the 18th century (Demoscope, 2004).

The struggle of humanity for the restriction of exogenous mortality is not yet finished, but by the end of the second millennium, it fits with good results. Factors of mortality that were earlier dominant have lost their power, people are dying not from those causes and not in those ages that before. Medicine played a major role in combating exogenous mortality. This is particularly true with the development of new sanitary conditions and the new role of medicine. Open and active dissemination - of antibiotics significantly increased the control of many infectious diseases, respiratory diseases and disease of digestive system. Further achievements in medicine allowed reducing mortality from the impact of exogenous factors. The century period in which there has been such significant change was very short compared with many thousands of years, during which the structure of mortality has not changed. Over a hundred years truly rapid leap was done, which had great importance for all subsequent development (Vishnevski 2005:61).

Important role in this process have also played socio-economic factors. As a result life expectancy has increased, especially in developed countries. All this has allowed reducing deaths sharply from epidemics and infectious diseases. Simultaneously, this led to an increase in the proportion of dying from circulatory diseases and neoplasms. (Demoscope, 2004)

At first, for the comprehensive explanation, we should define epidemiological transition theory in the context of Western (European) experience. In essence, the theory of epidemiological transition implements three main phases, during which mortality and diseases are varied in humans. The first stage is best known as a period of famine and murrain.

The first phase was characterized as high mortality and fertility. By reason of the high - infectious diseases prevalence, deaths took away a huge number of human lives. People make it difficult to fight against an epidemic, that’s why there were significant fluctuations, which prevented the sustained growth of the population. Major breakthroughs in combating the mortality during the first epidemiological transition has been made due to paternalist strategies for human health and life, based on mass prevention activities that did not require much engagement from everyone. The new decline in mortality, which occurred afterwards, had a different pathway (Caselli, Mesle and Vallin 2004:2).

Progressively, the first stage was replaced by the second, which is termed the "age of receding pandemics". The second stage of epidemiological transition is characterized by reduced morbidity and mortality from some other exogenous causes, primarily from infectious diseases such as tuberculosis, gastrointestinal infections, childhood infections, etc. However, in the second stage starts increasing morbidity and mortality from quasi-endogenous causes, such as diseases of the circulatory system, neoplasms, which in this case are displaced in an increasingly young age. This increase is a result of increasing pollution due to the rapid and uncontrolled process of industrialization and associated increase in physical and psychological pressures, leading to stress and nervous breakdowns. At the same time mortality increased from the accidents, particularly in manufacture (Demoscope, 2004).

The third stage of epidemiological transition characterized by overcoming the above-mentioned negative consequences of the industrialization process. People begin to protect environment for the overall improvement of living conditions of people, their conditions of work and life. One of the main criteria for the development of new technology is its safety, the absence or minimization of risks to

health and life. More people are beginning to lead a healthy lifestyle, get rid of bad habits, exercise, eat healthy food and follow all reasonable safety standards. Further success of prevention and medicine reduce morbidity and mortality from many causes. As a result, average life expectancy increases including rise in such an important parameter of social development, as the average expected age of death from most diseases (Gaylin and Kates 1997:610).

In 1986, Olshansky and Ault[4] supposed the emergence of 4th stage of epidemiological transition. It can be assumed that the fourth stage began only recently, which is typical for countries with low mortality and higher life expectancy. At this stage there is a further reduction in mortality from endogenous causes markedly improved prevention and treatment of congenital diseases associated with genetic disorders and congenital abnormality of fetal development. Infant and adolescence mortality continues to decline as a sign of an explicit medical progress, and mortality among the elderly is becoming less visible, which is caused by an aging process. It is about promoting lifestyles that help to reduce the risk mortality of non-infectious origin, especially cardiovascular diseases and cancer. Rational diet (with the reduction of fat and calories in particular), enough sleep and exercise, give up smoking and moderation in alcohol consumption - these healthy habits should lead to a lengthening of life expectancy (Gaylin and Kates 1997:610).

Taking into account strong and weak points of the epidemiological transition concept, we have to emphasize, that primary success in the struggle against mortality during the first epidemiological transition has been made thanks to paternalistic strategies for human health and life, based on mass prevention activities. Possibilities of the former strategy for reducing mortality have been exhausted with the completion of the first epidemiological transition. The new reduction in mortality occurred otherwise. Humanity has come to the second stage of transition, when it took out a new strategy, a new type of prevention aimed at reducing the risk of death from diseases of noninfectious origin, particularly cardiovascular disease and cancer, as well as from accidents, violence and other similar reasons directly related to diseases. This strategy required more active and conscious attitude towards their health by everyone, so much great material costs for the protection and restoration of health, which in turn has helped to increase its social value. Negative events of the last two stages can be called an accelerated growth of chronic and congenital diseases associated with genetic disorders.

[4] Olshansky, S.J. and Ault, B (1986). The forth stage of the epidemiological transition: the age of delayed degenerative disease. Milbank Quarterly 64 (3), 355-391

Chapter 4

Research questions and hypothesis

4.1 Research questions

Research questions of diploma thesis are based on aforementioned goals and objectives of the sub-chapter 1.2. Consequently, following questions are considered:

- What are the mortality development of malignant neoplasms in comparison with circulatory system diseases and other causes of death?
- What is the difference between West and post-communist Europe in mortality development of malignant neoplasms?
- What is the most prevailing type of cancer among other frequent form of malignant neoplasms in mortality development of the EU?
- What is the difference between West and post-communist Europe in development of lung cancer mortality?
- What are the most vulnerable age-groups among men and women affected by lung cancer mortality?
- What are the major risk factors contributing to the development of lung cancer?
- What countries of the European Union are mostly prevailing in tobacco smoking?

4.2 Initial hypotheses

Initial hypotheses are the guesses or better say red-marks throughout the thesis on which we can rely on. They allow us to structure the principal importance of the thesis, which are: whether our hypotheses are accurate and reliable?

As it was already mentioned, tobacco smoking continues to remain the most serious problem in the world. Over the past few decades, male mortality from lung cancer was declining in many countries of the European Union (For example: Belgium, Finland, Italy, the Netherlands and the United Kingdom). However, this fact does not change the situation cardinally in a positive direction. Judging by recent trends, tobacco smoking increased among women. The present thesis tends to dispose the following hypotheses:

1. The recent high level of mortality from malignant neoplasms in different part of the EU (West and post-communist Europe) might be related to several causes such as insufficient policy against tobacco smoking, low retail prices for cigarettes, alcohol drinking, improper feeding (addicted to fast food diet), the problem of overweight, sedentary lifestyle, stress, economic instability (mostly in Baltic States), lack of quality equipment (screening, mammography) to detect oncological diseases and their accessibility to the population.
2. Recent changes in mortality trends indicate that many European countries have made significant progress in the fight against circulatory diseases, while malignant neoplasms remain a serious problem. If mortality development from neoplasms will continue to increase, we can expect that these types of diseases will become the leading and the most frequent cause of death among males and females in the majority of the European Union countries.
3. For several decades, mortality from lung cancer among European men can be considered as the most prevalent, while breast cancer remains the most frequent cause of death among women. However, recent changes in mortality development (particularly in Western Europe) show an increase of women death cases from lung cancer. Increasing trend of lung cancer may reflect the fact that in coming decade lung cancer will be a major source of mortality in both male and female population of the European Union.
4. As has already been proved in many studies[5], the risk of lung cancer development depends on the dose and duration of smoking: greater seniority and high consumption increase the likelihood of disease development. Intensity of lung cancer mortality among women has been increasing over the last few decades, while among men the trend is gradually declining. If tobacco smoking will remain high, lung cancer mortality in female population may increase.
5. It can be assumed that lung cancer develops mostly after the age 45 and further, and for its development requires long life expectancy, therefore despite the negative effects of tobacco smoking, which causes malignant neoplasms of the lung, the most vulnerable group are the elderly people.

[5] M. T. Muñoz Sastre., E. Mullet and P. C. Sorum (1999). Relationship between Cigarette Dose and Perceived Risk of Lung Cancer. University of François-Rabelais, F-37041 Tours, France and Albany Medical College, Albany, New York, 12208
Jay H. Lubin and Neil E. Caporaso (2005) Cigarette Smoking and Lung Cancer: Modeling Total Exposure and Intensity. Division of Cancer Epidemiology and Genetics, National Cancer Institute and Genetic Epidemiology Branch

Chapter 5

Data sources and methods

Chapter five is dedicated to data sources and research methods. Completeness and accuracy of data help us to get qualitative results. Methods allow us to achieve accurate results.

5.1. Data sources

Mortality and other demographical data for calculating trends in age standardized mortality rates in the European Union countries were extracted from mortality database of the World Health Organization () and the European Health for All Databases (HFA-DB) (http://www.euro.who.int/) Data were obtained separately for males and females, by 5 year age-groups from age 0 to 85+.
An appropriate data for the analysis were extracted for the following countries:

Tab 1: List of selected countries of the European Union according to available years

Austria	1980-2006	Italy	1980-2006
Belgium	1980-2004	Latvia	1980-2006
Bulgaria	1980-2006	Lithuania	1981-2006
Czech Republic	1986-2006	Netherlands	1980-2006
Denmark	1980-2006	Poland	1980-2006
Estonia	1981-2006	Portugal	1980-2004
Finland	1980-2006	Romania	1980-2006
France	1980-2006	Slovakia	1992-2005
Germany	1990-2006	Slovenia	1985-2006
Greece	1980-2006	Spain	1980-2005
Hungary	1980-2006	Sweden	1980-2006
Ireland	1980-2006	United Kingdom	1980-2006

Source: WHO Mortality database and ICD (http:/ / www. who. int/ classifications/icd/en/)

In May 2004 the European Union enlarged into the union of the 25 member states. However, the data were available only for 24 countries and in most cases covers period of 1980-2006. Almost all countries in the European Union were used for mortality estimation, except Cyprus, Malta and Luxembourg, due to small population.

It should be noted that several countries have insufficient data. To provide an overview of the recent mortality patterns of all malignant neoplasms and lung cancer, we divided all countries in two geopolitical regions (western countries and post-communist countries).

For the entire study period (1980-2006) three different revisions (8th, 9th and 10th) of the International Classification of Diseases (ICD) were used. The ICD is a basic normative document, which is used by medics and demographers worldwide. Every 10 years the document is reviewed. The publication consists of three volumes, which include instruction, classification and index. The aim of ICD is to create conditions for the systematic recording, analysis, interpretation and comparison of mortality and morbidity data, obtained in different countries or regions and at different times. The idea of developing the ICD was due to necessity of more efficient storage and retrieval of diagnostic data. William Farr was the first who paid attention to the importance of a standardized statistical nomenclature of causes of death. In 1855, Farr introduced the classification of death in the Second International Statistical Congress. In 1900 the ICD was firstly recognized as an International list of death causes. Since then, 10 consecutive revisions were published. (M. Moriyama, 1966:1277). In terms of availability of data on cancer, the most convenient in our study are 8th, 9th and 10th revisions. Due to new discoveries in medical science, many improvements have been made to the coding of the 10th revision. Unlike the ICD-8 and ICD-9, the ICD-10 code includes greater detail, changes in terminology, and expanded concepts for injuries, laterality, and other related factors. The complexity of ICD-10 provides many benefits because of the increased level of detail conveyed in the codes. But, in many ways, the ICD-10 and ICD-9 are quite similar. Anyone who extracts data from 9th revision should be able to make the transition to coding 10th revision; therefore, despite the differences and innovations that contain in the revisions, the right sort of data, allow us to achieve qualitative results.

In order to calculate lung cancer mortality, the most frequent types of malignant neoplasms such as breast, bladder, colon and rectum, stomach and prostate cancer was used. Moreover, for an efficient international comparison we also employed circulatory diseases and other causes of death, in order to give comprehensive explanations for the processes described.

Tab 2: List of selected causes of death according the revisions of the International Classification of Diseases

Causes of death	ICD-8 Codes		ICD-9 Codes		ICD-10 Codes	
	ICD codes	WHO MD codes	ICD codes	WHO MD codes	ICD codes	WHO MD codes
1. Circulatory diseases	390-458	A080-A088	390-459	B25-B30 (CH17)	1064	I00-I99
2.Neoplasms	140-199	A045-A058	140-239	B08-B17	1026-1047	C00-D48
MN of bladder	188	A058	188	B126	1041	C67
MN of breast	174	A054	174	B113	1036	C50
MN of colon, rectum and anus	152-154	A048-A049	153-154	B093-B094	1030	C18-C21
MN of trachea, bronchus and lung	162	A051	161-162	B101	1034	C33-C34
MN neoplasm of prostate	185	A057	185	B124	1040	C61
MN of stomach	151	A047	151	B091	1029	C16

Source: WHO Mortality database and ICD (http:/ / www. who. int/ classifications/icd/en/)

The lack of data in some former socialist countries may be explained by reforms in healthcare system or they do not provide information to the WHO database due to other reasons such as lag in updating the registers according to the WHO standards or inconsistency with an old health care system. Incompleteness of data can be a reason to above mentioned problems. During several decades post-communist European states were under complex reforms. The collapse of communist regimes between 1989 and 1991 was very painful for the economy of some East European countries (for

example: Poland, Bulgaria, Romania and Baltic States). The new governments of Eastern European countries inherited many problems from its predecessors. We suppose that transition period from old centralized health care system to new West model was not an easy process. Therefore, it is likely that **"some"** of the statistics of the former socialist countries of Eastern Europe do not quite meet the requirements of WHO so era of 90's brought significant changes in standards of gathering data.

Health data - figures and statistics are mandatory elements to track the situation and trends in health and helps to evaluate the impact of public policies and health programs. Data on mortality from lung cancer for the European Union were taken from the central database of the WHO, which includes independent, comparable and updated statistical information on key health indicators. It serves as principal source of information on public health in the European countries. The WHO supports the 53 Member States in the WHO European Region in developing and sustaining their national health policies, health systems and public health programmes; to identify, prevent and overcome potential threats to health; anticipating future challenges; and advocating public health. This provides an important opportunity for comparison and analyses of health trends in the region, observation and detection of the most dangerous diseases for the population, as well as, for inducing a systematic policy to promote healthy lifestyles. In general, reliability and accessibility can be judged positively due to well-structuralized sets of data and its consistency.

5.2. Methods

5.2.1 Direct method of standardization

In order to compare two or more groups with different internal age structure in epidemiological studies, standardized mortality rates are calculated. The method of indicators' standardization allows to compare the aggregated data which has different internal age structure. It consists of calculating new indices, based on the assumption that the internal structures of the studied populations correspond to the structure of the sets taken as a sample (standard).

Historically, in the middle of the 19th century, the need for age standardization was recognized before the general concept of confounding was formalized. The first idea of a truly international standard was suggested in 1892 by Ogle. In May, 1965 at a meeting of the International Union Against Cancer (IUAC) conference in London this matter was thoroughly discussed and three standard populations were suggested. Each of the three proposed standards has been specifically designed for particular population types. One standard with a high proportion of young people was appropriate for making comparisons with populations in Africa. The second one, it calls "European", was focused on Scandinavian populations, which contained relatively high proportion of old people and it was most acceptable to compare Western Europe. The third one was intended as "world" standard based on the experience of 46 countries. Eventually, "European" and "world" standards were adopted by the WHO for use in calculating age-standardized death rates. For international comparisons of standardized coefficients and for the state mortality statistics two types of age structure are used: World and European standards (Ahmad et al. 2001:4).

Demographers and medical workers in England argued that simple crude rate was inapplicable for comparing population's mortality or morbidity when the age distribution of two or more regions was

substantially different. It should be noted that the earliest epidemiological studies of age standardization appeared in a publication of F. G. P. Neison in 1844. Moreover, he clearly introduced two major approaches of direct and indirect standardization (Ahmad et al. 2001:4).

There are two possibilities of computing standardized death rates – direct and indirect. Direct standardization is often preferred method especially in epidemiological contexts (For example: analysis of cancer incidence and mortality). For comparison of overall mortality rates using direct standardization is necessary to calculate the number of deaths that could be recorded in this population if the age composition of the population coincided with the age composition of the population-standard. The direct standardization can be used in the study of a sufficiently large population, where age-specific factors in the population are stable and consistent. It should be noted, when the population is small, then the number of events in the target population can also be small. In contrast to direct standardization, indirect method is highly reliable in context of small population. Therefore, analyzing data of 24 countries of the European Union by direct standardization is most suitable. The formula for direct standardization can be expressed as:

$$\text{SDR (}\textbf{Standardized Death Rate}\text{)} = [\text{Sum}_{\text{ age groups}} (M_{ar} P_{as})]/P_s \text{ x } 1000$$

M_{ar} is the age specific mortality rate for the region

P_{as} is the number of people in the age group in the standard population

P_s is the total standard population

They eliminate the differences in the age composition of the population and therefore more accurately reflect to the relative levels of mortality in the spatial and temporal comparisons. Based on the foregoing, the direct method of standardization is especially useful when comparing the death rates by cause of death, as the standardized mortality rate from a group of causes of death is the sum of the standardized mortality rates from each of the causes of the group.

5.2.2. Cluster analysis

Before speaking regarding the results of the cluster analysis it is always good idea to understand cluster analysis itself. The first application of cluster analysis was found in sociology. The title of the cluster analysis is derived from British word cluster – "cluster" (accumulation). The first founders of cluster analysis were researcher Tryon, Ward and Johnson[6]. The big advantage of cluster analysis is that it allows creating decomposition of objects not only by one parameter, but also in whole groups i.e. clusters. Cluster analysis enables to distinguish a large amount of information, make them compact and visual. Currently, except statistics and sociology, it also widely disseminated in analysis of demographic data. For instance, in this work the cluster analysis is used for treatment and providing comprehensive information on trends by lung cancer mortality among European Union countries (Dostal and Pokorny 1991:1).

Cluster analysis represents a collection of statistical methods, which allow us to identify groups of samples that behave similarly or show similar characteristics. In any scientific activity classification is a fundamental component, without which the construction and testing of scientific

[6] Tryon R. (1939), Cluster analysis. Edward Brothers, Ann Arbor, Michigan.
Johnson S.C., (1967), "Hierarchical Clustering Schemes" *Psychometrica, 4, 58-67.*
Ward J.H. (1963), "Hierarchical Grouping to Optimize an Objective Function", *Journal of American Statistical Association, 58, 236-244.*

hypotheses is impossible. As a result of cluster analysis predefined variables form the observation group. Observation refers to individuals (respondents) or any other objects. Members of one group (one cluster) should have similar manifestations of variables, and members of different groups should have different variables. The cluster analysis makes it possible to divide the entire initial set of indicators of conjuncture groups (clusters) on the relevant criteria, thus facilitating the selection of the most representative indicators.

To analysis of lung cancer data, the SPSS program was used. SPSS (Statistical Package for the Social Sciences) statistical system is a universal program that supports the process of analyzing data at any level and is intended to implement the complete sequence of steps of data analysis: viewing the data, creating tables and calculating descriptive statistics. It is important to note, that SPSS has three different procedures that can be used for data clustering: hierarchical cluster analysis, k-means cluster and two-step cluster. If we have a large data file (for example: even 1,000 cases are large for clustering) or a mixture of continuous and categorical variables, the two-step procedure is more suitable than other methods. On the other hand, if we have a small data set and we want to find solutions with an increase of clusters, we have to use a hierarchical clustering. K-means clustering is a method which aims to partition observations into k-clusters in which each observation belongs to the cluster with the nearest mean.

There are many ways in which clusters can be formed. One of the most common and simplest methods is hierarchical clustering. In statistics, under the term of hierarchical clustering we understand the method of cluster analysis which seeks to build a hierarchy of clusters. Algorithms for hierarchical clustering are generally either agglomerative or divisive. Agglomerative clustering starts with each object in a separate cluster. Clusters are combined, grouping objects every time in more and larger clusters. This process continues until all objects do not become members of a single cluster. Divisive clustering starts with all objects that are grouped in a single cluster. The main advantage of hierarchical clustering methods is their visibility. That's why unlike other methods, hierarchical clustering led us to create a hierarchy of clusters, which can be represented as a tree structure called a "**dendrogram**". The Dendrogram can be found as a graphical representation of results of consecutive clustering which implements in definition of matrix distance and with dendrogram we can graphically or geometrically display the function of a clustering. There are many ways to build dendrogram. In dendrogram objects are placed vertically on the left, the results of clustering – on the right. The distances or similarities, corresponding to structure of new clusters, represented by horizontal line over dendrogram. There are two advantages of hierarchical clustering: firstly it's simple and a structure is more informative, secondly it does not require us to pre-specify the number of clusters. The disadvantages is that selection of merge or split points is critical once a group of objects is merged or split, it will operate on the newly generated clusters and will not undo what was done previously. Thus merge or split decisions may lead to low-quality clusters if not well chosen.

Measure of proximity (similarity) of objects can be conveniently represented as the reciprocal distance between objects. The most accessible perception and understanding in case of quantitative traits is so-called Squared Euclidean distance. Distance is a measure of how far apart two objects are, while similarity measures how similar two objects are. The Squared Euclidean distance helps us to get the same results in terms of boundary delineation as the Euclidean distance. There is a formula that can be expressed as:

$$\boldsymbol{d} = \sum_{i=1}^{n} \left(x_i - y_i \right)^2$$

In contrast to Euclidean Distance the deriving of Squared Euclidean distance (d) between two data points (x) and (y) does not involve computing the square root of the sum of the squares of the differences between corresponding values. Clusters are divided (split) until each object will not appear in a separate cluster. In the method, which is installed on SPSS by default “Between-groups linkage” (connection between the groups), the distance between clusters is the average value of distances between all possible pairs of observations, one observation is taken from one cluster and one from another. Information needed to calculate the distance, is on the basis of all theoretically possible pairs of observations. When we clustering cases we must standardize the variables, therefore z-scores is the most appropriate way in standardizing data. We mainly use it when some similarity measures are sensitive to differences in the variance of variables.

Chapter 6

Risk factors and preventive measures

6.1. Risk factors

The fact that effect of all carcinogenic substances on the human body in our society has long been known, but nonetheless, we continue to deliberately expose ourselves to many risk factors. On the threshold of the 21st century we have seen that not only external exogenous factors can cause harm to humans, but also a lot of other circumstances, to which we are exposed on our own. We suppose that one of the crucial factors is the poor nutrition, disease transmitted through food, and lack of safe access to safe food. Moreover, we can add an overweight and obesity, sedentary and immobile lifestyle, depression and stress that result in serious and progressive damage, which gradually affects the appearance of malignant neoplasms.

Lung cancer, as well as general cancer of any location, does not occur on healthy soil. It is preceded by lengthy pathological processes caused by one or another etiologic factor. It is generally accepted that lung cancer can cause various adverse of environmental factors. Among the most common reasons in this regard is dust containing radioactive sub- position, chromates, or asbestos. We have to take into account, that one of the fundamental reasons is our everyday life, in which we waste a lot of time for drinking alcohol and smoking cigarettes. About all these harmful effects and factors we describe in details in the following chapter.

6.1.1 Smoking

Massive distribution of smoking has become an international issue. Smoking has been called the plague of the twentieth century. Tobacco smoking continues to kill more than 5 million people worldwide each year – more than HIV/AIDS, tuberculosis and most likely this number will grow (WHO, 2008). Smoking is a social problem in society, both for smoking and non-smoking part. For the first - the problem is to quit smoking for the second - to avoid the influence of smoking society and not "get" their habit, and - save your health from tobacco products. Tobacco smoking - addiction, one might even say drug addiction. This is one of the most common types of drug addiction, covering a large number of people and is home abuse.

Many do not know that smoking, which begins with “pampering”, “desire to imitate”, “not to remain out of fashion”, “grow faster”, turns into an insidious habit, which is harmful to health.

Smoking is especially harmful to young, developing organism. It binds the will, undermines health, and shortens life. Cigarette smoking and all sorts of tobacco products have a negative impact on nearly every human organ. Smoking, regardless of the number of consumed cigarettes per day, always sooner or later leads to the diseases like: coronary heart disease, chronic bronchitis, pulmonary emphysema, bronchial asthma and finally cancer. Lung cancer is the typical disease associated with tobacco smoking. Negative impact of smoking products causes 80-90% of all lung cancer death, and about 30% of all cancer death in developing countries, including death cancer of the oral cavity, larynx, oesophagus and stomach (WHO, 2002). There is evidence that the smoking among people in developed countries are slow declining, but burden of tobacco use is increasing in low- and middle-income countries, and will increase more rapidly in these countries in coming decades (WHO, 2009). Recent statistics show that about 70% of tobacco users live in developing countries, and about half of the men in these countries are smokers. Smoking prevalence is lower among women than men in most countries, but it is important to know that approximately 200 million of one billion smokers in the world are women (WHO, 2010).

Mortality due to smoking among women is still rising in many European countries and continues to be a serious problem. The use of tobacco among young women in countries with large populations is among the most ominous trends. Tobacco companies have long understood the importance of women and girls in the overall market for cigarettes and therefore continue to lure women to expand their customer base. Smoking impacts women's health in the specific way. In scientific literature there is quite a lot of evidence on the impact of smoking on reproductive function of women. The World Health Organization states that about 22 percent of women in developed countries and 9 percent of women in developing countries smoke tobacco. In the WHO European Region, 21% of women smoke: more than in any other region in the world, but still significantly less than the 59% of European men who smoke (WHO, 2010).

In addition, we must know that the risk of lung cancer declines steadily in people who stop smoking, after 10 years, the risk becomes 30-50% less of that in continuing smokers (Commission of the European Communities, 1999:7). Smoking not only causes many diseases but assists to the evolution or better say directly stimulates the development of disease by weakening the protective reaction of the organism.

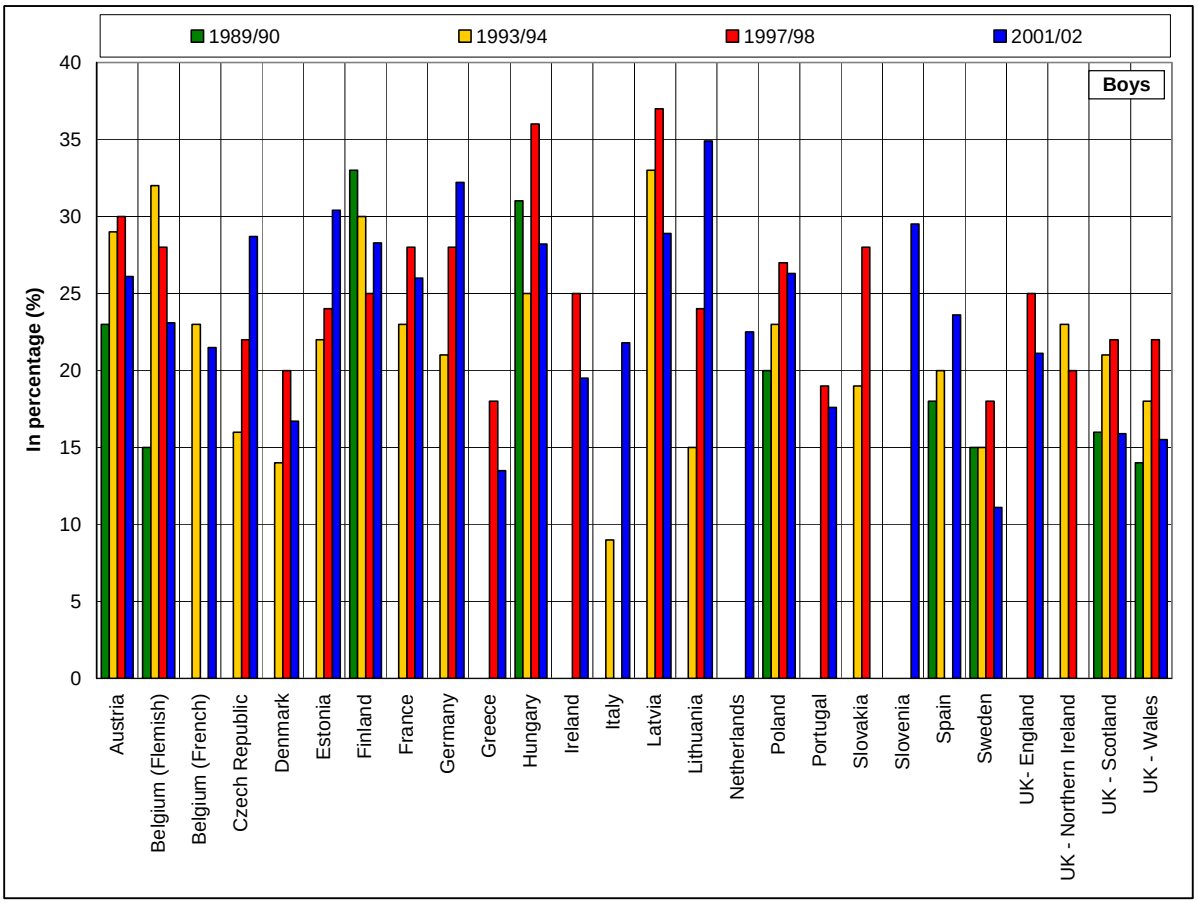
6.1. 2 Tobacco consumption

Global consumption of cigarettes has been rising steadily since manufactured cigarettes were introduced at the beginning of the 20th century. While consumption is decreasing in some countries, more people in worldwide are smoking cigarettes (WHO, 2009).

The uniqueness of tobacco is that it is the only legally distributed product that causes harm. Tobacco continues to operate in market only due to the fact that smoking is widespread among diverse population groups that are strongly dependent on it. We regret to note that many people underestimate the deleterious effects of tobacco on health and are loyal to smoking. Also, we must take into account that those representatives of tobacco companies, recognizing "the possible negative consequences" of smoking to health, justify its existence for the benefit of economic development, job creation, filling the budget through taxes.

This part analyzes and describes a tendency of cigarette smoking among males and females population of the EU countries. According to graphical indicators we have an opportunity to reveal not only gender differentiation in tobacco dependency, but also a distinction among all the countries.

Fig. 1-Prevalence of smoking, EU countries, 15 year old, boys (1989/90, 1993/94, 1997/98 and 2001/02)

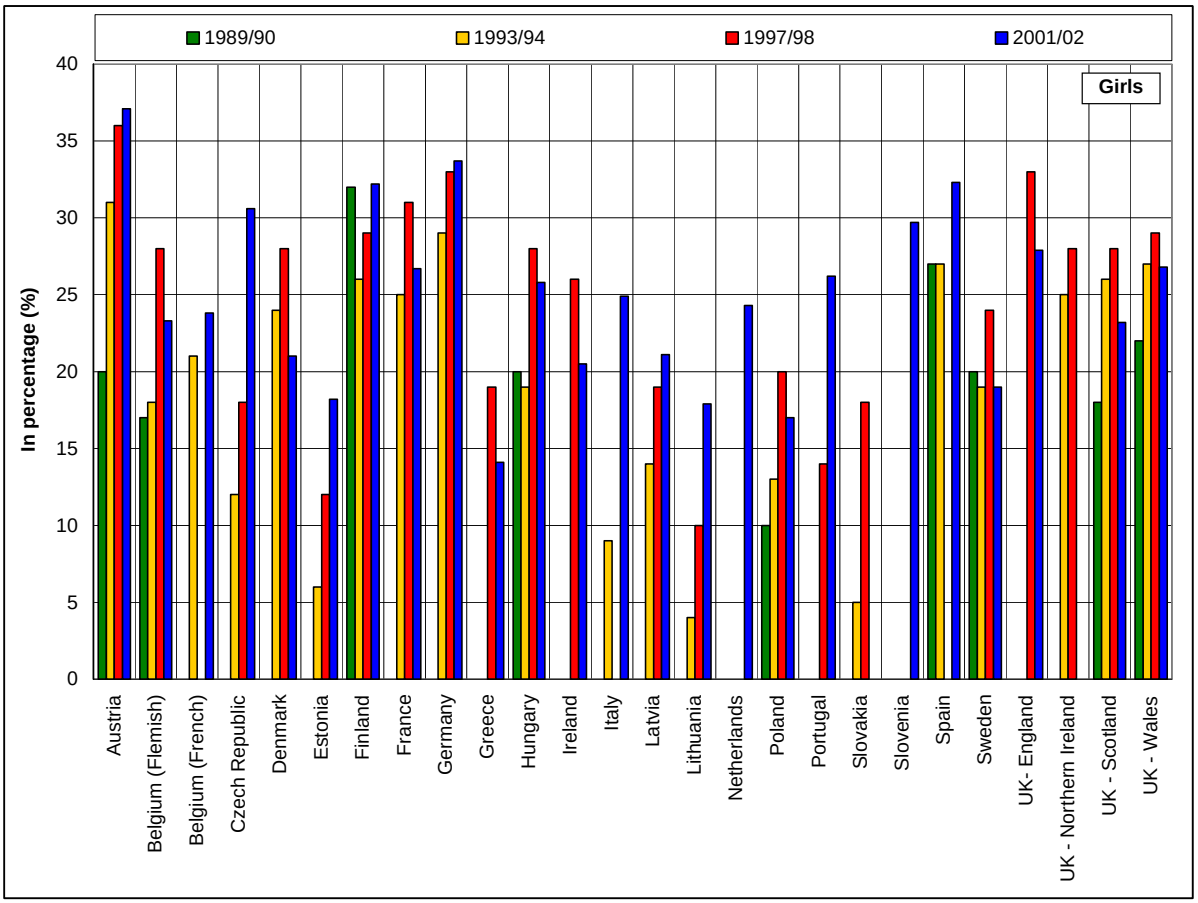


Notes: Smoking defined as smoking at least once a week

Source: World Health Organization (2003) Young people's health in context. Health Behavior in School-aged Children (HBSC) study: international report from the 2001/02 survey.
WHO: Copenhagen, and previous editions

Figure 1 shows that the prevalence of tobacco smoking was very heterogeneous among most of the European Union countries. From 1989 to 1990 the highest level (31-33%) of tobacco smoking among boys was observed in Hungary and Finland, while the lowest rate was observed in Sweden (15%). During the period from 1993 to 1994, intense smoking was observed in Latvia (33%), Belgium (32%) and Austria (29%). Significantly lower level of smoking habit was recorded in Italy (9%). From 1997 to 1998 high level of tobacco smoking was observed among Latvian (37%), Hungarian (36%) and Austrian adolescents (30%). Only in Germany and Sweden was this level the lowest (18%) among other countries. In subsequent years (2001-2002) smoking among boys significantly increased in Lithuania (35%) and Germany (32%). The opposite trend was observed in Sweden (11%). In contrast to the above mentioned countries, the most favorable trends from tobacco smoking were recorded in Greece (14%), Denmark (17%) and Portugal (19%).

Fig. 2-Prevalence of smoking, EU countries, 15 year old, girls (1989/90, 1993/94, 1997/98 and 2001/02)



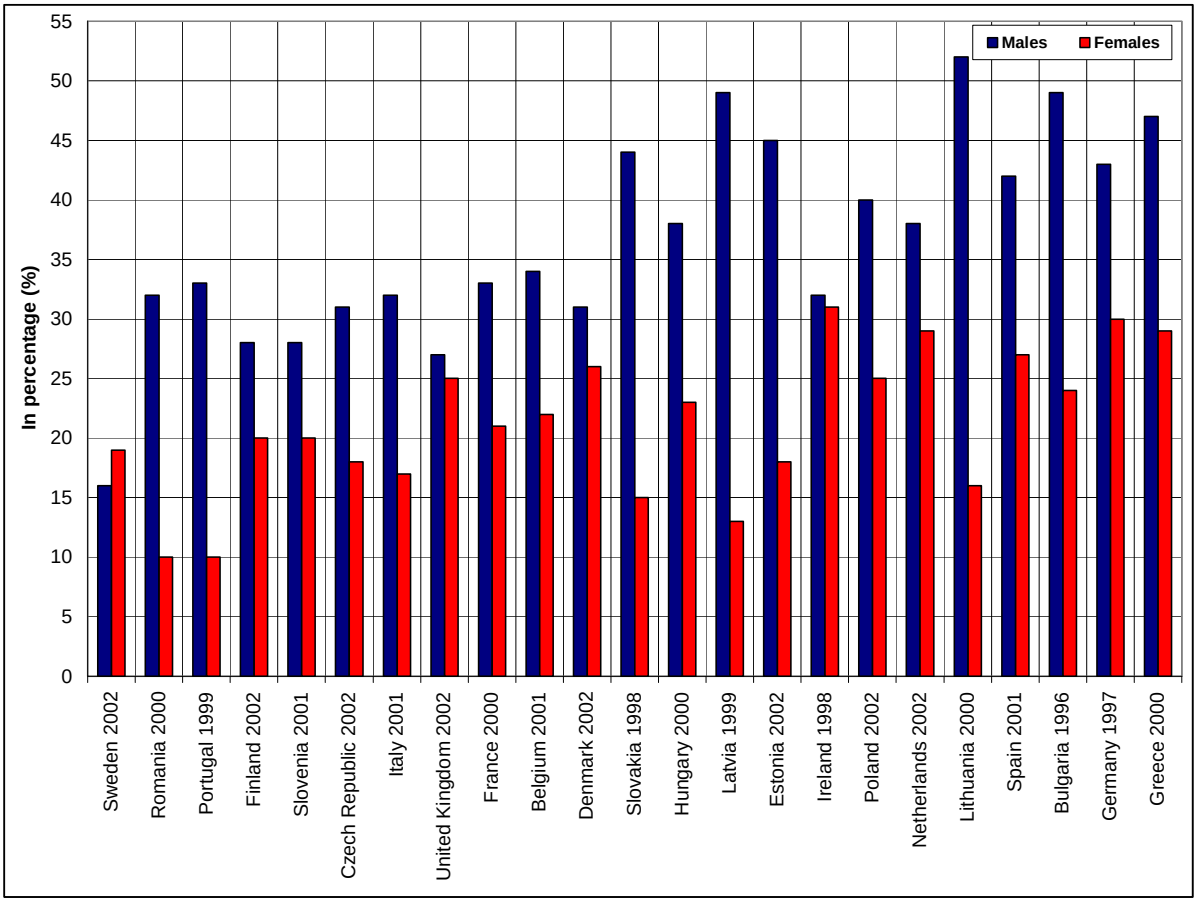
Notes: Smoking defined as smoking at least once a week

Source: World Health Organization (2003) Young people's health in context. Health Behavior in School-aged Children (HBSC) study: international report from the 2001/02 survey.
WHO: Copenhagen, and previous editions

According to Figure 2, it can be noted that smoking habits among girls was extraordinarily high in Finland (32%) and Spain (27%), while in Poland it was considered low (10%). In 1993 and 1994 the highest levels of tobacco consumption were observed in Austria (31%), Germany (29%), Finland (26%), Spain (27%) and the United Kingdom (27%). Smoking patterns recorded in Lithuania (4%), Estonia (6%) and Slovakia (5%) were substantially lower. In 1997 and 1998, smoking remained on extremely high level in Austria (36%), and continued to increase in the United Kingdom (33%), Germany (33%), France (31%) and Denmark (29%). In Lithuania and Estonia, tobacco consumption was less frequent (10-12%). In the later study period (2001-2002) tobacco smoking substantially increased in most of the Western European countries (e.g. Austria, Germany and Spain).

Based on the above analysis, it can be emphasized that tobacco consumption of the young women was differentiated across most of the European Union countries. In contrast to the former communist countries (e.g. Poland, Slovakia and Estonia), tobacco smoking was the most frequent in Western Europe.

Fig. 3-Prevalence of smoking, EU countries, according to sex, adults aged 15 and over, latest available year



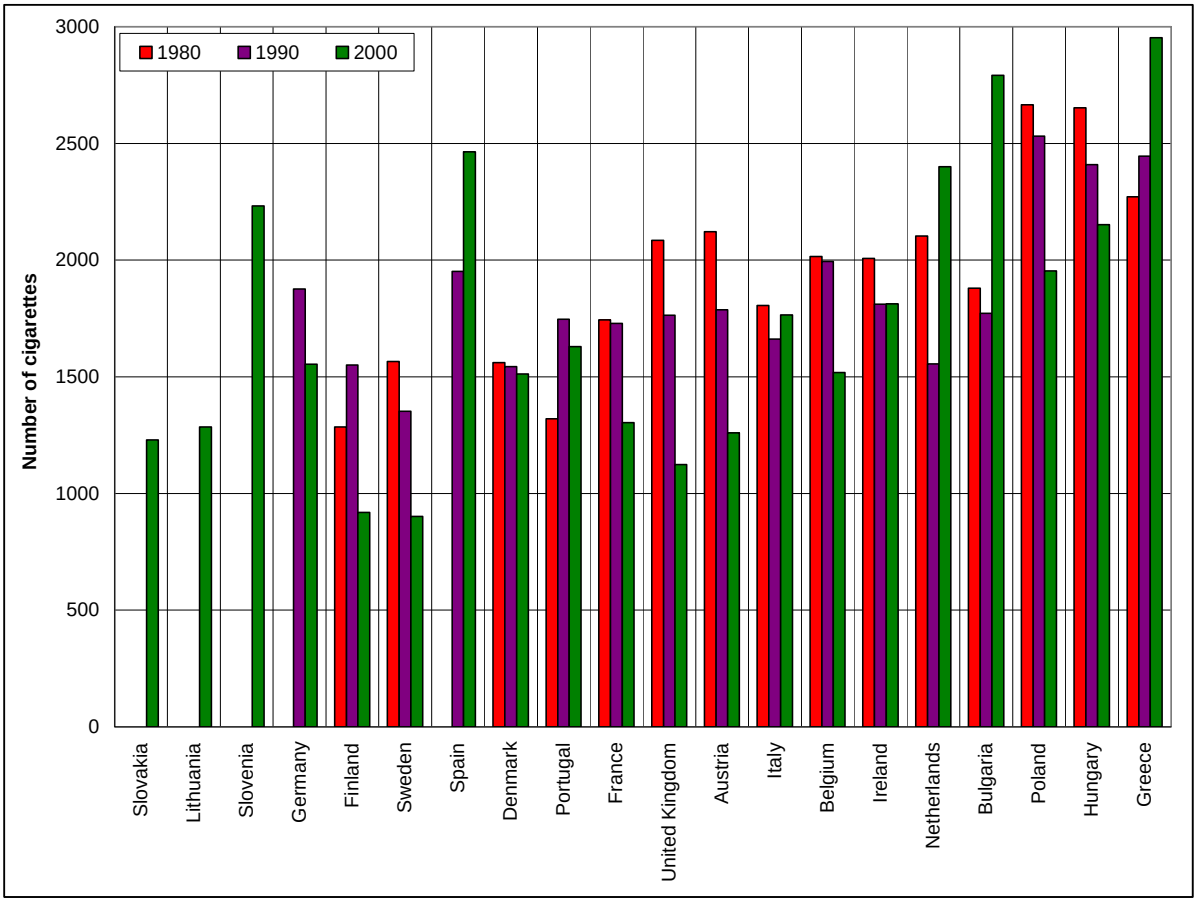
Notes: "Smoking" defined as regular daily smoking

Source: World Health Organization (2004) European Health for All statistical databases (http://www.who.dk})

Notes: "Smoking" defined as regular daily smoking

According to Figure 3, it can be observed that smoking prevalence is not at the same level in the European countries. Tobacco smoking among males was extremely high in the countries such as Lithuania (52%), Latvia (49%), Bulgaria (49%), Greece (47%), Estonia (45%) and Slovakia (44%), while the lowest level was observed in Sweden (16%). The average level of tobacco smoking was observed in Finland (28%), Slovenia (28%) and United Kingdom (27%). In contrast to smoking men, tobacco consumption among women remained low, but nevertheless, the countries with high and low level of smokers can be identified. Tobacco smoking among women was at the highets level in the following countries: Ireland (31%), Germany (30%), Netherlands and Greece (29%). The lowest percentage of tobacco smokers was observed the Czech Republic (18%) Italy (17%) and Slovakia (15%), while in Romania and Portugal it was even lower (10%). From the second half of the 90's to 2002 smoking prevalence of the male popultion significantly increased. Based on the above analysis, it can be determined that prevalence of tobacco smoking among men was observed in the former communist European countries (Germany, Poland, Bulgaria, Slovakia and the Baltic States) at the higher levels while in most of Western Europe smoking was less frequent.

Fig. 4- Number of cigarettes consumed per person per year, EU countries, according to sex, selected years



Source: World Health Organization (2004) European Health for All statistical databases

Figure 4 shows a cigarette consumption of the male and female population which can be described as heterogeneous among the European Union countries. In 1980, the highest number of cigarettes was consumed by Polish (2666), Hungarian (2652) and Greek people (2271). Relatively low level of cigarette consumption was observed in Finland (1285cigarretes) and Portugal (1320 cigarretes). In contrast to previous years, cigarette consumption significantly increased in 1990. The highest level of cigarette smoking still remained in Hungary, Poland and Greece. Also, smoking was significantly frequent in Belgium (1994 cigarretes), Spain (1952 cigarretes) and Germany (1876 cigarretes). The lowest level was observed in Sweden (1353 cigarettes). Further development of cigarette smoking substantially increased the level of cigarette consumption in many European Union countries. It is important to note that in 2000 high levels of cigarette consumption were observed in Greece (2953 cigarretes) Bulgaria (2792 cigarretes), Spain (2464 cigarretes) and the Netherlands (2401 cigarretes). Cigarrete smoking was less frequent in Sweden and Finland (902-918 cigarettes).

To conclude this part, it must be emphasized that smoking remains the most common and attractive habits among people, causing damage to both sexes and society as a whole. Smoking still involves almost all the segments of the population, particularly women and the youth. Over the past few decades smoking has significantly increased among young women in Western countries, as well as among men in the former socialist countries of Europe.

6.1.3 Passive smoking

Evidence that passive smoking can result in serious illness or even death among non-smokers first appeared in the English-language scientific journals in 1974 (Colley, Holland and Korkhill 1974:1031). Since that time, there have been literally dozens of independent scientific investigations of the relationship between passive smoking and a variety of health problems.

Passive smoking - inhaling the ambient air with its products, tobacco smoke of others. Over 4,000 chemicals have been identified in tobacco smoke, at least 250 which are known to be harmful, and more than 50 of which have been found to contribute to the emergence of cancer (WHO, 2009). Passive smoking as well as many calls it second-hand tobacco smoke (SHS) may be present in virtually all public places where people gather, namely, pubs, cafes, restaurants, night clubs and many other places. Often people do not think about the harm caused to them by tobacco smoke. Many people believe that cigarettes harm only to those who smoke however it is false statement. Passive smoking also causes organism to irreparable damage. It is necessary to know that passive smoking contributes to the development of diseases peculiar to smokers. The harm of smoking for people, who are in the same room with a smoker, arises from the fact that it is forced to absorb substances secreted by the so-called "side stream" smoke. The main stream of smoke gets into the lungs of the smoker, but the part that released into the air, inhaled by all who are nearby. Passive smoking is inevitable with regular stays close to the smokers. There are many facts about the effects of passive smoking on children's health. Infants and toddlers are particularly vulnerable to the effects of passive smoking due to the fact that their bodies are still in the stage of growth and formation, and because they breathe faster than adults (Donaldson and Gilmore 2010:180). It should be taken into account the fact that children are most receptive to tobacco smoke, so scientists have given convincing evidence that passive smoking has a lasting impact on the respiratory system of children.

The harm of passive smoking is a key argument of the introduction of policies regulating smoking and tobacco products. Despite the fact that information about the danger of passive smoking appeared a long ago, the tobacco industry tried to sow doubt in order to prevent regulation of their products.

6.1.4 Asbestos Fiber

Asbestos is one of the most significant occupational carcinogens, which accounted for about half of all deaths from cancer caused by occupational circumstances (WHO, 2010). Exposure to asbestos occurs from inhalation of polluted air in the working environment, as well as from ambient air near the sources of such contamination or indoor friable asbestos-containing materials. The most exposed to asbestos fibers are the workers of companies engaged in thermal and acoustic insulation. Today, asbestos use is restricted or prohibited in many countries. Lung cancer and mezothelioma often caused by exposure to asbestos fibers.

We can suppose that workers family members heavily exposed to asbestos, thus an increased risk of developing mesothelioma[7]. This might be resulted from exposure to asbestos fibers brought into the home on the shoes, clothing, skin, and hair of workers. Many studies have shown that the

[7] Mesothelioma is a form of cancer that develops from the protective lining that covers many of the body’s internal organs. It is usually caused by expose to asbestos.

combination of smoking and asbestos exposure is particularly hazardous. Smokers who are also exposed to asbestos have a risk of developing lung cancer that is greater than the individual risks of asbestos and smoking added together. There is some evidence that quitting smoking can reduce the risk of lung cancer among asbestos-exposed workers (Vainio et al. 1993:191) Smoking combined with asbestos exposure does not appear to increase the risk of mesothelioma. However, people who were exposed to asbestos on the job at any time during their life or who suspect they may have been exposed should not smoke.

6.1.5 Radon

Let us dig into only one carcinogenic factor which could be found in almost any basement of the houses, contributing to the appearance of lung cancer - for radon and its short-lived decay products. Many people are exposed to radon in homes. The concentration of radon in the contiguous houses may be different, and its concentration in the same home can change daily or even hourly. Because of these fluctuations, estimating the annual mean concentration of radon in indoor air requires measurements of mean radon concentrations for at least three months. Radon gas can penetrate through the soil and get into the house through the pipes, windows and chimneys. Therefore, the amount of radon released from the earth's crust, is significantly different in the air in different locations around the globe. Radon gas - an invisible and odorless, but it can be detected by simple specialized devices.

6.1.6 Occupational factors

The important role in the occurrence of lung cancer is occupational factors. It is proved that the risk of lung cancer elevates in the workers of aluminum industry, coke, iron and steel melting in the underground mining of hematite, as well as among workers dealing with radioactive substances, arsenic and its compounds, coal tar, nickel and its compounds, rubber industry, etc (Boffetta and Nyberg 2003:72) It should be stressed that a respiratory system diseases and lung cancer are exposed not only by workers of heavy industry, but including all those who daily absorb large amount of dust. Thus, any carcinogenic effects such as dust particles can cause serious damage to our respiratory system, which turn, causes lung cancer risk.

6.1.7 Air pollution

There is no doubt that inhalation of carcinogenic dust was a contributing factor to the increase of lung cancer frequency. In fact, it is difficult to assume that thousands of tons of coal dust, bits of tar and resins, as well as other products of incomplete combustion, which are daily thrown into the air from the chimneys of factories, automobiles and diesel engines, would not damage lungs and not cause a chronic inflammatory process that in itself is a predisposing factor in lung cancer development, not to mention the direct carcinogenic effect of inhaled particles (Uglov 1959:11).

However, existing epidemiological data on air pollution as an etiological factor of lung cancer indicates that air pollution is likely to affect the development of this disease, but the effect of smoking and occupational factors is much more visible.

6.1.8 Genetic predisposition

While most cases of lung cancer are associated with smoking, genetic predisposition is still a big factor of disease development, supported by numerous studies[8]. The presence of certain lung diseases, particularly chronic obstructive pulmonary disease, is associated with an increased risk of lung cancer. It is very important to understand that individual risk factors can affect the cancer. Genes play an important role in our life and they control most of the processes that occur inside human body. In normal life, genes are capable to support cell division and growth. When damage occurs in genes - mutations - can develop cancer. The families which had cases of illness or death from cancer, especially at a young age, fall into the high-risk group. For example, a woman whose mother or sister had breast cancer have twice the risk of developing cancer compared to those families that did not have the disease. Those families, who have indicated an increased incidence of cancers, should begin regular screening at a younger age and pass them more frequently. Patients with genetic syndromes, transmitted in the family, will be determined by individual risk for each family member (Mohandas 2001:482).

6.2 Prevention

The cancer prevention issue nowadays with no doubt will be considered with more attention as lung cancer as one of the most common cause of mortality. Disease prevention becomes increasingly important. Scientists around the world recognize that only the wide application of science-based prevention of diseases will help mankind cope with this scourge. Currently there are only two ways to fight against malignant tumors: prevention and diagnosis at earlier stages, which allows to "freeze" the cancer for many years and successfully treat it (Khuri 2003:40). Prevention of lung cancer should consist of two components:

a) Under the primary prevention of lung cancer we mean a prevention of cancer by removing or neutralizing the impact of environmental factors and lifestyle. It is very important to quit smoking and avoid exposure to potentially cancer-causing substances at work. Rational diet which contents a lot of fruits and vegetables help us to reduce a risk of lung cancer.

b) Secondary prevention (screening) includes lungs preventive examinations, as well as the treatment of precancerous diseases of the lungs. Screening Screening studies have only been done among high risk populations, such as smokers and workers with occupational exposure to certain substances. This is because radiation exposure from repeated screening studies could actually induce cancer formation in a small percentage of screened subjects, so this risk should be mitigated by a (relatively) high prevalence of lung cancer in the population being screened. ScreeningThey also include long-term tobacco smoking as well as those recovered earlier from malignant neoplasms. Observation of such patients is aiming to retrieve early forms of lung cancer for better treatment and prevention of lethal cases. Generally speaking, measures such as lifestyle changes and improvement strategies for prevention and screening can be reused to reduce mortality from this disease (Adami, Trichopoulos and Willett 2001:126).

[8] Steven A. Frank (2004). Genetic predisposition to cancer – insights from population genetics. Department of Ecology and Evolutionary Biology, University of California, USA, p-746
P Hutter, A Couturier, R J Scott (1996) Complex genetic predisposition to cancer in an extended HNPCC family with an ancestral hMLH1 mutation, Division de Genetique Medicale, CMU, Geneve, Switzerland, p 33:636-640.

6.3 European policy against tobacco

In 1987, Europe was the first WHO Region which took the initiative on five-year Action Plan for "Tobacco-Free Region". Over the past period from 1987 three action plans on tobacco control were adopted, which set tasks related to all major aspects of tobacco control policy. In the First European Action Plan of "Tobacco-free Europe" (1987-199) member states developed and adopted a comprehensive and multidisciplinary approach in this area. It also urged countries to establish an effective system for monitoring and evaluating their tobacco control measures. Second Action Plan (1992-1996) was aimed to increase financial support and national capacity for tobacco control and contained a recommendation to strengthen cooperation with Central, Eastern and Southern Europe. In order to take more effective measures, Third Action Plan for "Tobacco-Free Europe" (1997-2001) was adopted on the forty-seventh session of the Regional Committee for Europe. Taking into account the results of the First and Second Action Plans and World Health Assembly resolutions calling for a comprehensive tobacco control strategies (WHO, 2002).

Since the adoption of the Third Action Plan approximately three quarters of European Member States have significantly reinforced their policies on tobacco taxation: two-thirds of countries have strengthened measures against smuggling; one third have introduced age restrictions on tobacco sales; and at least eight countries introduced a complete ban or strict restrictions on direct advertising, which in turn significantly improved the rules on smoking in public places. In addition, since 1997, about one third of Member States have created intersectoral coordinating committees, and half of them have adopted national plans of action on tobacco control.

Scientific research and successful practical examples in the European region and in other parts of the world suggest that, thanks to flexible, differentiated and creative strategies, tobacco consumption can be reduced. In turn, significantly improving health and achieving substantial economic gains. Recommended actions, as described in this section are based on the best available evidence and experience in the field of tobacco control, which was acquired in European Region. Tobacco control programs must be comprehensive and include at least the following components:

- Higher taxes on cigarettes and other tobacco products;
- Restrictions on tobacco products;
- Bans on smoking in public places;
- Comprehensive bans on the advertising and promotion of all tobacco products;
- The fight against smuggling;
- Large, direct warning labels on cigarette boxes and other tobacco products;
- Help for smokers who wish to quit;
- Public information and public opinion.

1. Tobacco control advocates agree that rising taxes on tobacco products is considered to be one of the most effective components to induce current smokers to quit, reduce consumption of heavy smokers and prevent uptake by non-smokers, especially for young and low income people who is highly price-responsive. Taxes need to be imposed on all tobacco products so that consumers cannot replace one cigarette product with another. Revenues received from taxes on tobacco products should be used to finance all activities related to tobacco control,

including health education, conducting research on regulation of tobacco and support for health services.

2. Restricting access to tobacco products to young people under the age of 18 is still an effective way of reducing the number of teenagers and young adults who become regular smokers. One way of introducing restrictions on the sale of tobacco products will ensure that such products are sold to customers only by hand and only by the seller who has appropriate license. Moreover, vendors should be held legally responsible for the checking of the age of customers.
3. Smoking control in public places allows minimizing and eventually eliminating the risk of passive smoking and helps to protect the rights of non-smokers. This law makes smoking socially unacceptable thing that keeps young people from acquiring this habit. It also supports the determination of a large number of people wishing to quit smoking.
4. Tobacco advertising and smoking among young people is a causal link, and strict measures against tobacco advertising can reduce both smoking in general and among young people. In order to achieve substantial and rapid reduction of tobacco use, especially among women and men – introduction of a complete ban on advertising tobacco products needed.
5. Apart from the fact that the smuggling of tobacco products poses a risk to public health, contributing to the increase of consumption, it also deprives governments' revenues from tobacco taxes. Until the smuggling of tobacco products is not maintained at the national and international levels, the impact of other tobacco control measures will be greatly weakened. Stamps on cigarette packages are an effective strategy for the payment of customs duty. Moreover, an active international control within the European Union as well as toughening the laws and penalties may also be useful for reducing illegal tobacco trade.
6. Mandated labels on tobacco products are an effective way to inform smokers about the dangers of smoking, which helps smokers to quit, at the same time preventing non-smokers not to start this bad habit. These warnings can be effective only if they contain some strong and direct message in a conspicuous place. In order to achieve effective results, it is necessary to increase the size of warnings on all cigarettes, and also to repaint all the bright colors of cigarette packs on less attractive colors (for example gray-green) which may substantially affect the consciousness of smokers. In addition, if on all tobacco products images of dead people or those organs that were exposed to the negative effects of carcinogens were stamped, it will help to discourage the demand for cigarettes.
7. Aid in smoking cessation - is an important and promising component of tobacco control strategies. It should be more widely adopted program to quit smoking, developed specifically for men or women. It necessary to attract highly qualified professionals who are able to systematically carry out educational and training programs tailored to gender and age specific populations and to ensure that smokers gave up this bad habit.
8. Intensive health education and anti-tobacco campaigns in media are effective ways to reduce smoking. It is very important to mobilize social movements against tobacco use and form a social climate conducive to reduce smoking. The public should have more information on structures, finance, database and political influence of tobacco industry. It is important that general public and especially children, youth and vulnerable groups are fully informed about

the medical and social consequences of tobacco smoking. Moreover, it is necessary to continue to closely work with social community and nongovernmental organizations to improve policies against smoking.

It is important to note that tobacco smoking continues to be one of the major health challenges facing the European WHO region. Solutions to this problem are well known. However, for their successful implementation requires political support and mobilization of all social forces.

6.4 European Policy against cancer

The purpose of this sub chapter is to identify the main requirements for policies and strategies of cancer control, emphasizing the basic elements of primary prevention, secondary prevention (screening), comprehensive care and advances in research, all at the national and EU level.

After cardiovascular diseases, cancer still remains a major public health problem in the EU. In order to develop and implement of a successful plan for cancer control, early detection and quality care remains as a major issue for all EU countries. The fight against cancer is one of the basic and essential priorities of the European Association of Public Health since 1985. Three programs for action, entitled "Europe against Cancer" have been successfully implemented in the period from 1987 to 2002. In April 2008, the European Parliament and European Council adopted a resolution cancer and the reduction of the cancer burden in the European Union (Boyle et al. 2003:1312).

The aim of national policies for cancer control is to improve the outcomes for patients and reduce cancer mortality. The EU has a big responsibility to improve public health and to ensure that all community policies and activities contribute to the protection of human health. The most important question is how to implement existing knowledge into effective strategies against cancer at the population level of the EU. To develop a comprehensive strategy for cancer control should be implemented four basic components:

1. Primary prevention: implementing measures in the fields of health promotion, lifestyle intervention and diseases prevention to decrease the exposure of individuals to key risk factors – special emphasis on children, young adults and women.
2. Secondary prevention: early detection of diseases, allows reducing premature mortality and improving quality of life of cancer patients. Organization of mass screening is the basic and the most effective priority for all EU countries.
3. Integrated care: ensuring the best treatment for all cancer patients. This requires the development of well-trained and highly skilled workers in various fields. Improving the quality of life of cancer patients and their families, through support, rehabilitation and palliative care.
4. Research on cancer is focused on finding new solutions for all aspects of cancer, by identifying new opportunities for prevention, early detection, diagnosis and treatment. This can be achieved by funding and supporting research on all levels - EU, national, and through a network of institutions.

The solution of the problems associated with oncological diseases at the national and international levels is vital. The first step is a detailed analysis of the recent and current situations. Nationally, this analysis must provide information on geographical and temporal structure of cancer morbidity,

mortality and survival, for each of the most frequent types of cancer. After that, it is necessary to establish priority areas for cancer control. Priority should be given to the development of national plans for cancer or - if such a plan already exists – to the evaluations of their achievements. One of the most important problems in health policy is to maintain a share of total national expenditure on health allocated to cancer control. Oncological assistance can still be considered one of the most complicated works, so it may require significant financial resources. This applies both to a sufficient number of highly qualified specialists and the availability of equipment and materials - cancer drugs and sophisticated diagnostic and therapeutic equipment, all of which can be quite expensive. Moreover, European health policy must recognize the exceptional importance and effectiveness of integrated information systems for the monitoring of cancer. The main suppliers of such information are cancer registries. Population based survey derived from cancer registries remain as an important tool for evaluating various measures to reduce the cancer burden of European population. Cancer research remains the most important initiatives for the future development of cancer. Research enables informing people about many ways of fighting against this terrible disease (e.g. the prevention, diagnosis and treatment of cancer). Researchers will bring new knowledge, ideas and solutions. In addition, an effective implementation of strategies in the fight against cancer can be achieved through increased public awareness of the harmfulness of such habits as a sedentary lifestyle, poor diet, obesity, alcohol, and smoking respectively (Albreht et al. 2008:1452)

It is important to emphasize that adequate cancer control requires a structured and coordinated approach at all levels of European society, (as international and regional levels), involving all interested parties (medics, demographers, politicians) , including cancer patients. Taking into account such factors as the vulnerability of older persons to cancer and continuing trends of aging of European population, we must continue to struggle against numerous factors contributing to the emergence of oncological diseases. Based on prevention, detection, and cost efficient care we can achieve optimal and favorable results. Well-designed, effective national cancer control programs are essential to succeed against this disease and to improve the quality of life for cancer patients.

Chapter 7

Mortality patterns

7.1 Mortality trends by the most important causes of death

Subchapter 6.1 describes mortality trends by the most important causes of death among males and females in the European Union countries. The primary aim of this part is focused on the discovery of mortality development from circulatory system diseases, malignant neoplasms and other causes of death. It is important to note that over the past century mortality and its causes had substantially changed in Europe and around the world. Numerous infectious diseases such as plague, cholera, tuberculosis were a serious threat to the lives of many European citizens. But all of these diseases have been left behind as well as significantly minimized due to a significant progress of medicine that successfully fights with them. From the second half of the 20th century in many European countries there have been quite significant changes in the structure of mortality. The high speed of industrialization of society and state, requiring high moral and physical resources could significantly affect the health of the European population. It is important to note that behavioral factors and health problems are closely interconnected, that is why such social phenomena as alcoholism, smoking, stress, poor diet and the lack of physical activity may directly affect the morbidity and mortality in many European countries. All these factors have played a crucial role. Society faced with chronic diseases of the circulatory system and cancer, which have become increasingly dominate. Currently, cardiovascular disease and neoplasms remains the most frequent and leading causes in both genders in the European Union countries.

According to obtained results, we can say that most of the Western European countries (e.g. France and Spain) had already achieved favorable decline of mortality caused by circulatory system diseases. In contrast to Western Europe, mortality development from cardiovascular disease and cancer is quite different in Eastern Europe. In transition period, many post-communist countries were behind of those crucial transformations, which Western countries had already gone. In particular, we can distinguish countries such as Latvia, Lithuania and Estonia, which experienced a collapse of the totalitarian regime, economic reforms from socialism to capitalism accompanied by numerous social problems that in turn could adversely affect the health of citizens.

Tab 3: Mortality caused by circulatory system diseases in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Males					
	Circulatory diseases			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	638.1	492.9	278.2	77.2	44	56
Belgium*	525.4	364.4	257.5	69.4	49	71
Bulgaria	715.8	813.0	821.8	113.6	115	101
Czech Republic	819.1	834.2	477.8	101.8	58	57
Denmark	555.0	472.8	243.8	85.2	44	52
Estonia*	984.3	926.6	688.8	94.1	70	74
Finland	696.2	563.3	317.2	80.9	46	56
France	381.8	267.3	174.3	70.0	46	65
Germany*	…	510.4	292.3	…	…	57
Greece	403.4	415.7	310.1	103.1	77	75
Hungary	843.3	806.3	590.7	95.6	70	73
Ireland	705.1	547.2	265.5	77.6	38	49
Italy	516.7	374.4	225.4	72.5	44	60
Latvia	940.5	878.8	779.2	93.4	83	89
Lithuania*	677.0	738.5	740.6	109.1	109	100
Netherlands	473.5	391.0	222.1	82.6	47	57
Poland	737.9	768.1	480.2	104.1	65	63
Portugal*	567.1	466.9	271.1	82.3	48	58
Romania	825.7	775.2	726.9	93.9	88	94
Slovakia	742.6	774.0	634.9	104.2	85	82
Slovenia	663.0	557.4	322.0	84.1	49	58
Spain	445.1	337.1	208.7	75.7	47	62
Sweden	568.2	446.0	261.9	78.5	46	59
United Kingdom	619.9	474.8	246.2	76.6	40	52

Notes: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004

Source: Author's own calculation based on data from WHO mortality database

Table 3 illustrates that mortality development from circulatory system diseases among males in the European Union countries was quite heterogeneous. From the beginning of 1980 a large number of deaths from cardiovascular disease were observed in most of the former socialist countries, but at the end of 1990 negative trends changed in a positive direction. From 1980 to 1990 mortality of the male population was significantly high in Lithuania, Latvia, Poland, Bulgaria, Greece, Slovakia and the Czech Republic, while in Belgium, Spain and the United Kingdom mortality rates were among the lowest. Index of mortality change shows that in subsequent years (1990-2006), mortality from circulatory system diseases among males was gradually deacreasing. The most favorable decline was observed in Ireland, Austria, Denmark, Finland, Germany, Slovenia and the United Kingdom. The highest death rates from circulatory system diseases of the male population were registered in Belgium and Lithuania. It can be noted that by the end of the 20th century most of the countries of the

European Union have made significant progress in reducing mortality from the circulatory system diseases.

Tab 4: Mortality caused by malignant neoplasms in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Males					
	Malignant neoplasms			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	288.8	271.9	212.3	94.2	74	78
Belgium*	324.3	307.6	235.3	94.8	73	77
Bulgaria	173.3	196.8	224.5	113.5	129	114
Czech Republic	336.2	358.7	284.2	106.7	85	79
Denmark	277.4	278.7	245.5	100.5	89	88
Estonia*	270.3	286.1	302.1	105.9	112	106
Finland	273.5	237.7	183.9	86.9	67	77
France	306.8	305.0	242.6	99.4	79	80
Germany*	…	275.6	210.9	…	…	77
Greece	205.1	215.5	207.4	105.1	101	96
Hungary	317.3	372.9	330.9	117.5	104	89
Ireland	253.7	269.7	218.7	106.3	86	81
Italy	274.0	291.3	223.5	106.3	82	77
Latvia	247.5	288.1	299.4	116.4	121	104
Lithuania*	244.3	283.0	299.5	115.9	123	106
Netherlands	311.7	301.2	234.6	96.6	75	78
Poland	265.1	299.5	293.6	113.0	111	98
Portugal*	212.2	217.1	216.2	102.3	102	100
Romania	191.8	190.0	240.8	99.1	126	127
Slovakia	265.7	314.0	301.5	118.2	113	96
Slovenia	300.5	294.6	277.4	98.0	92	94
Spain	222.3	261.1	232.8	117.4	105	89
Sweden	197.9	199.5	178.3	100.8	90	89
United Kingdom	287.0	278.7	215.6	97.1	75	77

Notes: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004
Source: Author's own calculation based on data from WHO mortality database

According to table 4, it can be seen that mortality development from neoplasm was homogeneous across the European Union countries. From 1980 to 1990 mortality from cancer was significantly similar in many countries. The highest death rates were recorded in Latvia, Lithuania, Estonia, Hungary and the Czech Republic. Mortality rate of the male population was the lowest in Finland, Austria, Belgium, Romania and the Netherlands. Mortality rate from neoplasms was gradually deacreasing in the period from 1990 to 2006. In comparison with previous years cancer mortality was changed in a positive direction in most of the European Union countries. Thus, mortality substantially reduced in the countries like Austria, Belgium, Denmark, Germany, Ireland, the Netherlands, the Czech Republic and the United Kingdom. In the countries such as Hungary, Romania, Bulgaria, Portugal and the Baltic States mortality development of the male population remained high and unfavorable.

Tab 5: Mortality caused by other causes of deaths in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Males					
	Other causes			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	434.8	315.29	257.5	72.5	59	82
Belgium	471.9	399.0	336.6	84.5	71	84
Bulgaria	567.0	427.4	307.0	75.4	54	72
Czech Republic	443.3	410.8	269.4	92.7	61	66
Denmark	448.1	391.2	341.5	87.3	76	87
Estonia*	560.9	486.1	472.9	86.7	84	97
Finland	455.8	395.1	315.9	86.7	69	80
France	490.5	385.0	302.8	78.5	62	79
Germany*	…	346.3	244.7	…	…	71
Greece	411.4	266.4	214.1	64.7	52	80
Hungary	607.0	531.7	409.1	87.6	67	77
Ireland	456.5	401.5	269.7	88.0	59	67
Italy	413.6	315.2	223.1	76.2	54	71
Latvia	540.3	545.17	539.3	100.9	100	99
Lithuania*	583.6	445.25	555.2	76.3	95	125
Netherlands	313.1	325.4	284.9	103.9	91	88
Poland	723.0	518.7	394.3	71.7	55	76
Portugal*	786.0	522.7	387.4	66.5	49	74
Romania	466.9	428.5	324.3	91.8	69	76
Slovakia*	…	454.6	350.5	…	…	77
Slovenia*	513.8	442.6	327.6	86.1	64	74
Spain	422.6	375.69	314.1	88.9	74	84
Sweden	310.2	272.0	228.9	87.7	74	84
United Kingdom	414.1	303.8	270.9	73.4	65	89

Notes: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004, Slovakia 1992, Slovenia 1985

Source: Author's own calculation based on data from WHO mortality database

Table 5 shows that in comparison with the circulatory system diseases, mortality development by other causes of death was substantially similar to the most of the Euopean Union countries. Initially (1980), male mortality was significantly high in Latvia, the Netherlands, Ireland, Spain and Sweden. Mortality rates were the lowest in Italy, Spain, Sweden, Greece and the United Kingdom. In subsequent years mortality rates from other causes of death remained substantially homogeneous in almost all countries of the European Union. The high mortality rate of the male population was typical to Lithuania, Latvia and Estonia.

Table 6 shows mortality differences from all causes of death among men. In the period from 1980 to 2006 high mortality levels of the male population were observed in Bulgaria, Hungary, Poland, the Netherlands, the Czech Republic and the Baltic States.

Tab 6: Mortality caused by all causes of deaths in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)

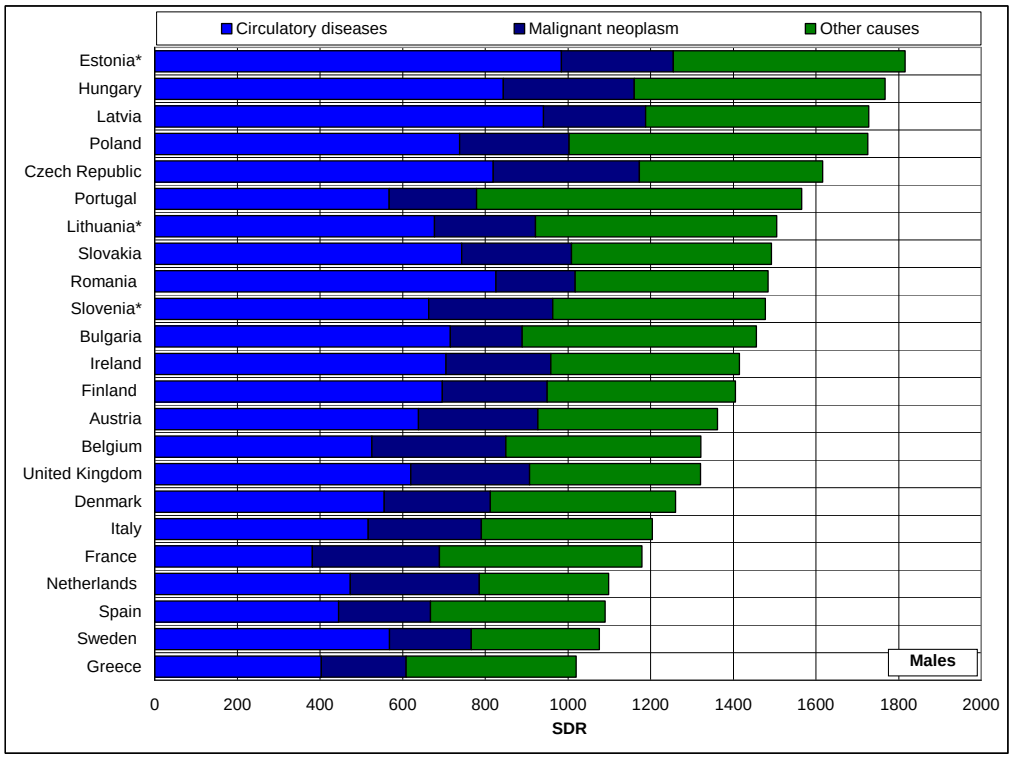
Countries	Males					
	All causes			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	1361.7	1080.06	748.0	79.3	55	69
Belgium	1321.6	1070.92	829.5	81.0	63	77
Bulgaria	1456.2	1437.09	1353.2	98.7	93	94
Czech Republic	1645.5	1606.43	1031.5	97.6	63	64
Denmark	1260.1	1118.31	830.8	88.7	66	74
Estonia*	1815.5	1698.86	1463.7	93.6	81	86
Finland	1405.1	1201.30	817.1	85.5	58	68
France	1179.2	957.27	719.7	81.2	61	75
Germany*	…	1132.3	747.9	…	…	66
Greece	1019.9	897.55	731.7	88.0	72	82
Hungary	1767.6	1710.9	1383.9	96.8	78	81
Ireland	1415.2	1218.5	756.9	86.1	53	62
Italy	1204.3	980.8	672.0	81.4	56	69
Latvia	1728.2	1712.10	1617.8	99.1	94	94
Lithuania*	1504.8	1466.72	1595.3	97.5	106	109
Netherlands	1098.3	1017.51	741.6	92.6	68	73
Poland	1725.9	1586.28	1168.2	91.9	68	74
Portugal*	1565.3	1210.66	874.7	77.3	56	72
Romania	1484.5	1393.65	1292.1	93.9	87	93
Slovakia*	…	1430.8	1286.9	…	…	90
Slovenia*	1477.3	1294.52	927.0	87.6	63	72
Spain	1090.1	973.86	755.5	89.3	69	78
Sweden	1076.4	922.37	669.1	85.7	62	73
United Kingdom	1321.0	1057.34	732.7	80.0	55	69

Notes: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004, Slovakia 1992, Slovenia 1985
Source: Author's own calculation based on data from WHO mortality database

From 1990 and 2006 mortality rates from all causes of death remained extraordinary high in the Baltic States, while the most favorable reduction was observed in countries such as Austria, Ireland, Italy, the Czech Republic, Finland and the United Kingdom.

As it was mentioned above, over the past few decades most of the European Union countries have made significant progress in reducing mortality rate of the male population caused by the circulatory system diseases and cancer. The favorable trends in many Western European countries resulted in implementing effective measures for their own recovery. Substantial changes in behavior such as tobacco smoking cessation, absistence from alcohol, eutrophy and physical activity will reduce the risk of the leading death causes like cancer and cardiovascular diseases.

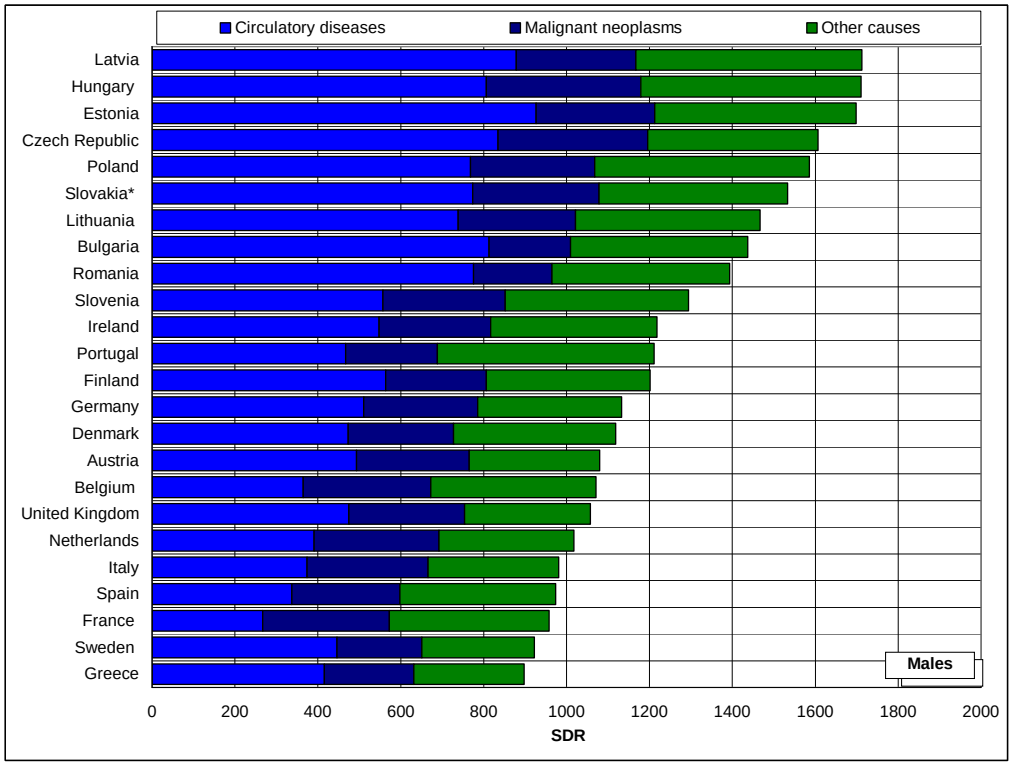
Fig. 5– Mortality caused by neoplasms and circulatory diseases, EU countries, 1980, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Estonia 1981, Lithuania 1981, Slovenia 1985,

Source: Author's own calculation based on data from WHO mortality database

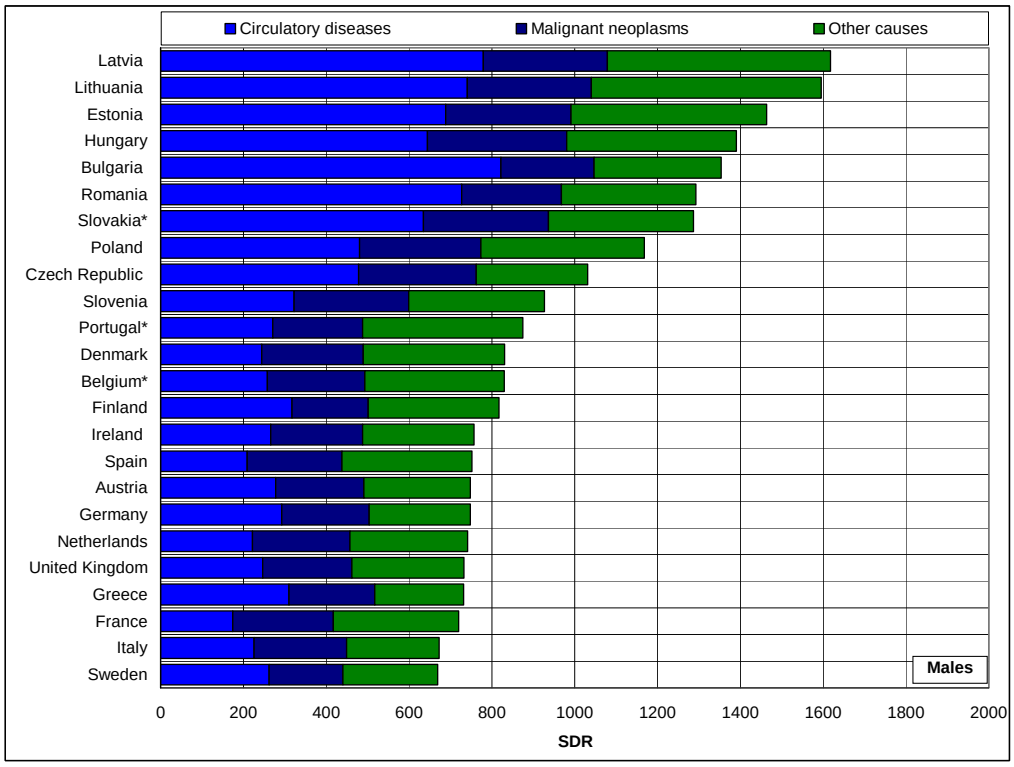
Fig. 6 - Mortality caused by neoplasms and circulatory diseases, EU countries, 1990, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Slovakia 1992

Source: Author's own calculation based on data from WHO mortality database

Fig. 7 - Mortality caused by neoplasms and circulatory diseases, EU countries, 2006, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Belgium 2004, Portugal 2003, Slovakia 2005,

Source: Author's own calculation based on data from WHO mortality database

Comparative analysis allows to reveal mortality development from malignant neoplasms, circulatory diseases and other causes of death. According to Figure 1 it can be highlighted that mortality development caused by circulatory system diseases in 1980th was very intense in most of the Eastern European countries (Estonia, Latvia, Hungary, the Czech Republic and Romania). The highest level was recorded in Estonia (984 deaths per 100 000 men). In comparison with Eastern Europe, mortality rates among Western countries (for example: the United Kingdom, Belgium, Denmark, France, Spain, Sweden and Greece) were significantly low. According to Figures 2 and 3 it can be seen that mortality development of the male population was gradually declining in most of the West European countries. In 1990s mortality rate from the circulatory system diseases was the lowest in France (267 deaths per 100 000 men), while in the Czech Republic it was one of the highest (926 deaths per 100 000 men). The most favorable death rates caused by neoplasms were recorded among Swedish men (204 deaths per 100 000 persons). Extremely high rate was observed in Hungary (372 deaths per 100 000 men). Mortality development from other causes of deaths was most common among the former socialist European countries, particular in Latvia (542 deaths per 100 000 men).The lowest death rates were recorded in Greece and Sweden (266-272 deaths per 100 000 men). In the later period of the study (2006) mortality from circulatory diseases patterns for the male population considered to be extraordinary high in Bulgaria (821 deaths per 100 000 men) and the lowest were observed in France (174 deaths per 100 000 men). Mortality rate caused by neoplasms remained high in Hungary (337 deaths per 100 000 men), while it was the lowest in Sweden (178 deaths per 100 000 men). Mortality patterns from other causes of deaths continued to be high in the Baltic States (539-555 deaths per 100 000 men). The lowest death rate was recorded among Greek males (214 deaths per 100 000 men).

Tab 7: Mortality caused by circulatory system diseases in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Females					
	Circulatory diseases			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	434.2	321.4	192.5	74	44	60
Belgium*	330.7	227.4	168.7	69	51	74
Bulgaria	567.7	586.4	540.8	103	95	92
Czech Republic	549.2	512.6	318.2	93	58	62
Denmark	315.9	280.3	154.4	89	49	55
Estonia*	611.3	557.8	360.3	91	59	65
Finland	383.3	311.8	171.3	81	45	55
France	230.4	159.3	102.1	69	44	64
Germany*		326.9	201.8	…	…	62
Greece	327.0	329.9	259.3	101	79	79
Hungary	574.0	524.5	401.4	91	70	77
Ireland	451.7	318.6	159.6	71	35	50
Italy	354.4	249.5	151.0	70	43	61
Latvia	608.6	543.2	421.1	89	69	78
Lithuania*	492.1	483.4	439.8	98	89	91
Netherlands	618.3	217.1	138.6	35	22	64
Poland	463.8	462.2	291.9	100	63	63
Portugal*	418.5	337.7	194.1	81	46	57
Romania	719.3	645.1	531.0	90	74	82
Slovakia	518.6	479.3	417.5	92	81	87
Slovenia	444.1	371.4	212.5	84	48	57
Spain	325.7	246.1	139.7	76	43	57
Sweden	323.8	255.8	162.9	79	50	64
United Kingdom	366.9	281.4	155.9	77	42	55

Notes: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004
Source: Author's own calculation based on data from WHO mortality database

Table 7 revelas that mortality patterns of the female population caused by circulatory system diseases were substantially homogeneous among most of the European Union countries. According to the index of mortality change, between 1980 and 1990, the highest death rate was recorded in Bulgaria, Greece and Poland. The lowest mortality rate was observed in the Netherlands. In addition, the favorable mortality patterns prevailed among French, Spanish, Belgian, Irish and Italian women. It is important to note that from 1990 to 2006 mortality rates from the circulatory system diseases were gradually declining in the European Union countries. Despite of this, the countries with sufficiently low and high rates of women's mortality can be distinguished. In such countries as Bulgaria, Romania, Hungary, Latvia, Lithuania, Slovakia female mortality rates were among the highest. Significant reduction of mortality patterns from the circulatorty system diseases was recorded in Austria, Belgium, Denmark, Finland, Ireland, Spain, the Netherlands, and the United Kingdom.

Tab 8: Mortality caused by malignant neoplasms in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Females					
	Malignant neoplasms			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	176.4	164.4	127.5	93	72	78
Belgium*	169.8	155.4	130.8	92	77	84
Bulgaria	111.8	117.1	124.2	105	111	106
Czech Republic	180.9	191.8	163.2	106	90	85
Denmark	188.0	201.4	182.1	107	97	90
Estonia*	139.2	143.7	143.4	103	103	100
Finland	140.8	136.9	113.4	97	81	83
France	142.7	133.6	112.2	94	79	84
Germany*	…	165.0	131.9	…	…	80
Greece	117.1	113.3	111.0	97	95	98
Hungary	191.7	197.3	172.7	103	90	88
Ireland	185.4	182.9	159.8	99	86	87
Italy	145.7	148.2	122.6	102	84	83
Latvia	134.6	142.3	145.5	106	108	102
Lithuania*	130.0	138.4	133.4	106	103	96
Netherlands	163.1	165.8	154.3	102	95	93
Poland	153.4	156.0	154.9	102	101	99
Portugal*	128.7	129.1	110.8	100	86	86
Romania	124.1	117.6	132.6	95	107	113
Slovakia	144.3	148.5	145.7	103	101	98
Slovenia	156.8	155.4	145.4	99	93	94
Spain	120.3	123.6	103.3	103	86	84
Sweden	159.6	144.2	135.3	90	85	94
United Kingdom	183.7	187.7	153.7	102	84	82

Notes: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004
Source: Author's own calculation based on data from WHO mortality database

According to Table 8, it can be noticed that mortality development of the female population caused by neoplasms was quite similar among the European Union countries. The index of mortality change shows that significantly high indices were observed in Bulgaria, Czech Republic, Denmark, Hungary, Italy, the Netherlands, Poland, Portugal, Slovakia, United Kingdom and the Baltic States. In contrast to the above-mentioned countries significantly low rates were recorded in Belgium, Austria and Sweden. From 1990 to 2006 mortality patterns of the female population were changed in a favorable direction in most of the countries of the European Union (e.g. Germany, Belgium, Finland, France, Sapin, the Czech Republic and the United Kingdom), while in Bulgaria, Romania, Poland, Slovakia and the Baltic States mortality remained high. It can be concluded that substantial diversity among Western and some Eastern European countries still remained throughout the entire period. Mortality patterns of the female population continued to be characterised by high death rates in most of the former socialist European countries.

Tab 9: Mortality caused by other causes of deaths in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Females					
	Other causes			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	211.3	157.7	139.7	75	66	89
Belgium	281.9	223.23	202.5	79	72	91
Bulgaria	331.2	227.0	150.1	69	45	66
Czech Republic	226.3	193.4	133.7	85	59	69
Denmark	225.4	234.3	231.6	104	103	99
Estonia*	190.1	183.8	165.7	97	87	90
Finland	213.9	198.1	162.8	93	76	82
France	251.9	203.5	162.9	81	65	80
Germany*		181.4	143.5	…	…	79
Greece	291.5	175.73	147.7	60	51	84
Hungary	295.3	245.40	183.6	83	62	75
Ireland	281.7	237.0	185.5	84	66	78
Italy	216.3	170.8	129.2	79	60	76
Latvia	181.6	213.7	220.5	118	121	103
Lithuania*	198.6	163.8	176.1	82	89	108
Netherlands	185.3	193.2	203.1	104	110	105
Poland	321.7	233.59	164.7	73	51	70
Portugal*	403.5	268.8	210.3	67	52	78
Romania	270.2	211.3	144.8	78	54	69
Slovakia*	…	212.0	151.0	…	…	71
Slovenia*	221.2	188.9	146.0	85	66	77
Spain	223.0	191.7	177.8	86	80	93
Sweden	178.4	159.4	154.6	89	87	97
United Kingdom	239.2	193.4	200.9	81	84	104

Note: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004, Slovakia 1992, Slovenia 1985

Source: Author's own calculation based on data from WHO mortality database

Table 9 shows that female mortality rates from other causes of death significantly varied among the countries of the European Union. According to the index of mortality changes, from 1980 to 1990, mortality patterns of the female population were recorded high in Latvia, Lithuania, Denmark and the Netherlands, while in Greece and Italy it was the lowest. In the period from 1990 to 2006 mortality rates among females were gradually declining in most of the European Union countries. The most favorable patterns were found in Bulgaria, Romania, the Czech Republic and Poland, while in Latvia, Lithuania, Denmark, the Netherlands and the United Kingdom women's mortality rate remained extremely high. It is important to note that throughout the entire period mortality development from other causes of deaths significantly decreased among many countries. Despite this fact, there are several countries such as Latvia, Denmark and the Netherlands, where mortality indices of the females continued to be very high.

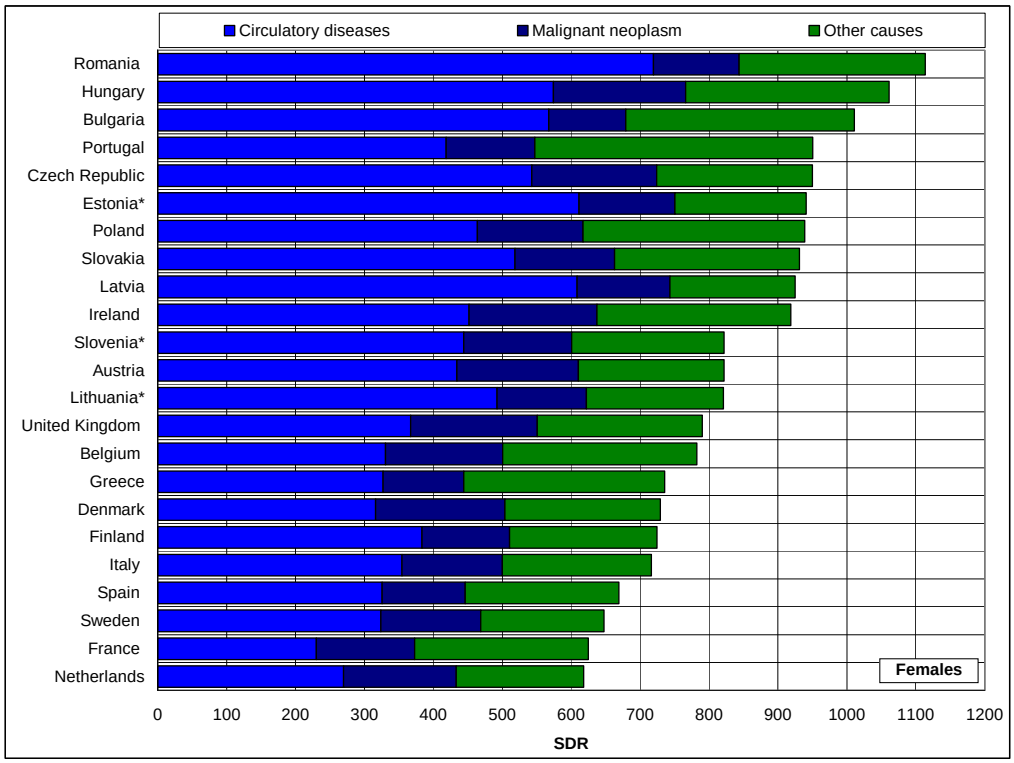
Tab 10: Mortality caused by all causes of deaths in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Females					
	All causes			Index (%)		
	1980	1990	2006	1990/1980	2006/1980	2006/1990
Austria	821.9	643.40	459.7	78	56	71
Belgium	782.4	606.07	501.9	77	64	83
Bulgaria	1010.7	740.53	815.1	73	81	110
Czech Republic	966.4	897.7	615.0	93	64	69
Denmark	729.3	702.51	568.1	96	78	81
Estonia*	940.6	885.29	669.4	94	71	76
Finland	724.5	651.2	447.5	90	62	69
France	624.9	496.35	377.2	79	60	76
Germany*	…	673.3	477.2	…	…	71
Greece	735.6	618.89	518.0	84	70	84
Hungary	1061.1	967.22	757.7	91	71	78
Ireland	918.8	738.5	504.9	80	55	68
Italy	716.5	568.43	402.8	79	56	71
Latvia	924.8	899.14	787.2	97	85	88
Lithuania*	820.7	785.6	749.4	96	91	95
Netherlands	618.3	576.1	496.0	93	80	86
Poland	939.0	851.77	611.5	91	65	72
Portugal*	950.7	735.7	515.2	77	54	70
Romania	1113.6	974.0	808.3	87	73	83
Slovakia*	…	780.5	714.1	…	…	92
Slovenia*	822.0	715.80	503.9	87	61	70
Spain	669.0	561.4	420.9	84	63	75
Sweden	647.3	563.4	452.7	87	70	80
United Kingdom	789.8	662.5	510.5	84	65	77

Note: Belgium 2004, Germany from 1990, Estonia 1981, Lithuania 1981, Portugal 2004, Slovakia 1992, Slovenia 1985
Source: Author's own calculation based on data from WHO mortality database

Table 10 illustrates mortality development of the female population caused by all causes of deaths. From 1980 to 1990 the mortality patterns among females were recorded as high in Denmark, Finland, the Netherlands, Hungary, Poland, the Czech Republic and the Baltic States, while in Austria, Belgium, Bulgaria, Italy, France and Portugal these patterns were considered low. In the period from 1990 to 2006 mortality increased in Bulgaria, Slovakia and remained high in Lithuania. In all other countries of the European Union mortality patterns from all causes of deaths changed in positive direction. It is important to note that throughout the entire period mortality development of the female population was gradually declining. It can be said that a significant and beneficial reduction in mortality among women in the European Union could be related to improving lives and health of the citizens, i.e. high level of social stability and the progress in medicine, which play an important role in people's lives.

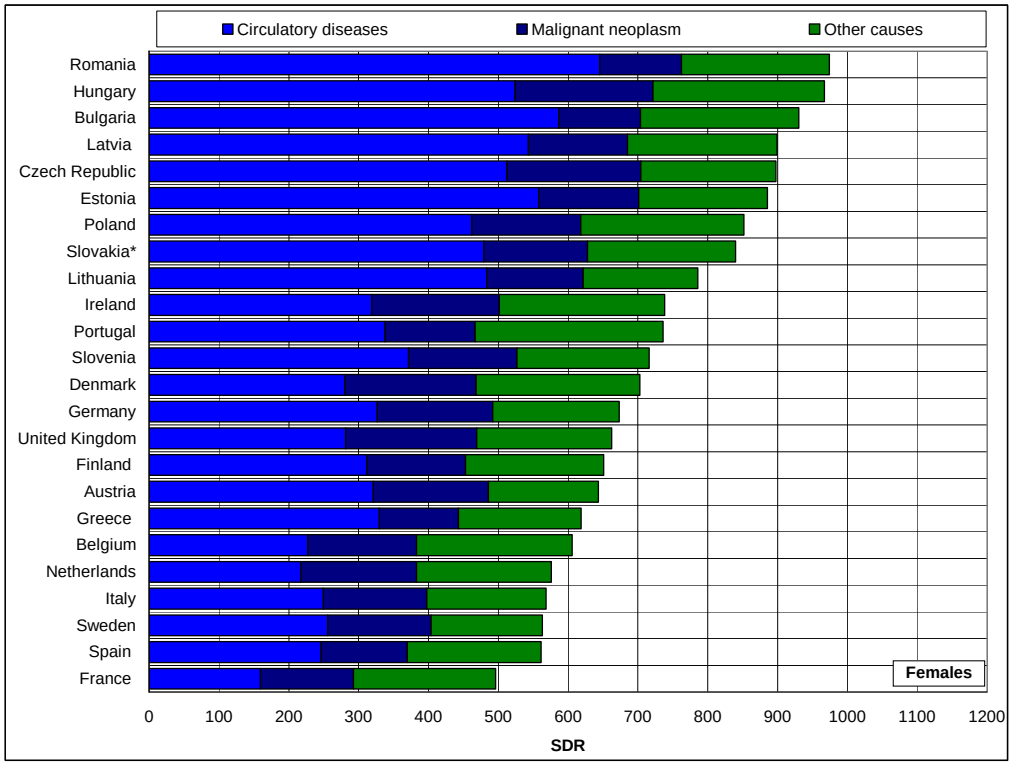
Fig. 8- Mortality caused by neoplasms and circulatory diseases, EU countries, 1980, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Estonia 1981, Lithuania 1981, Slovenia 1985,

Source: Author's own calculation based on data from WHO mortality database

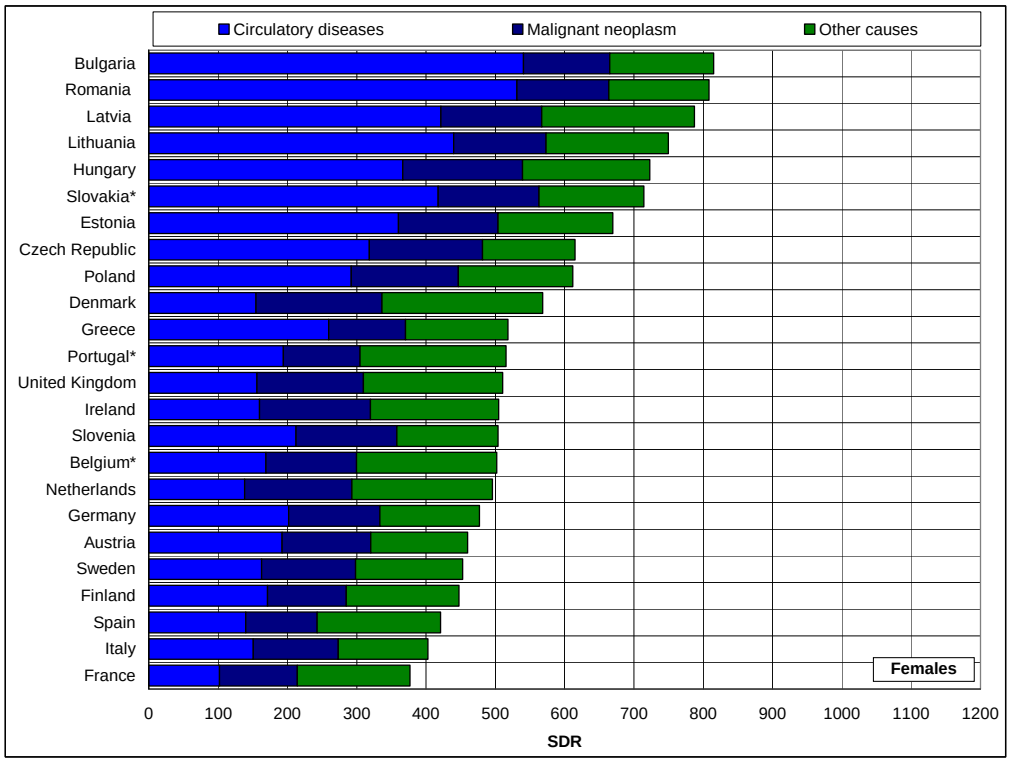
Fig. 9- Mortality caused by neoplasms and circulatory diseases, EU countries, 1990, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Slovakia 1992

Source: Author's own calculation based on data from WHO mortality database

Fig. 10- Mortality caused by neoplasms and circulatory diseases, EU countries, 2006, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Belgium 2004, Portugal 2003, Slovakia 2005

Source: Author's own calculation based on data from WHO mortality database

According to Figure 8, it can be concluded that mortality development of the female population caused by the circulatory system diseases was the highest in Romania (719 deaths per 100 000 women). Also, mortality patterns were significantly high in Bulgaria, Hungary, the Czech Republic, Slovakia and the Baltic States. The lowest death rate was recorded among French women (230 deaths per 100 000 women). In comparison with the circulatory system diseases, development of cancer mortality was similar in most of the European Union countries. The highest death rate was in Hungary (191 deaths per 100 000 women), while the lowest was observed in Greece. Mortality development from other causes of death was significantly different between Western and post-communist Europe. It is important to note that mortality patterns were extraordinary high (403 deaths per 100 000 women) among Portuguese women. The lowest death rate was observed in Sweden (178 deaths per 100 000 women). Figure 9 reveals that most of the European women were suffering from the circulatory system diseases. Mortality level was extremely high in Romania (719 deaths per 100.000 women) as well in Bulgaria, Slovakia, the Czech Republic, Hungary and the Baltic States. The lowest death rate was recorded in France (230 deaths per 100.000 women). Mortality development from neoplasms was considered as high among Hungarian and Czech women (191-197 deaths per 100 000 women), the lowest was observed in Greece (113 deaths per 100 000 women). In regards to other causes of deaths mortality patterns were homogeneous among the European Union countries.

Figure 10 shows that mortality development from the circulatory system diseases, malignant neoplasms and other causes of deaths was gradually declining in most of the Western European countries (e.g. France, Belgium, Italy, Spain, Sweden and the the Netherlands), while mortality patterns remained extremely high among the former socialist European countries (e.g. Bulgaria, Romania, Hungary, Slovakia and the Baltic States).

7.2 Malignant neoplasms within mortality development

The epidemiological transformation that took place after the Second World War in Europe was delayed in the Eastern European countries compared to countries of Northern and Western Europe. However, as death rates from cardiovascular disease have begun to fall since the 1990s, malignant neoplasms has emerged as the most common cause of death among young and middle-aged adult women (20-64 years old) in the Central and Eastern European countries. It seems likely to be the leading cause of death among young and middle-aged adult men (Zatonski and Didkowsa 2008:1425).

Europe comprises only one-eighth of the total world's population, but despite this, one quarter of the global total cancer cases – some 3.2 million new patients each year are observed in Europe (F, Bray, 2008:7). It is important to note that mortality development from neoplasms in Europe is still determined by the vector of West and East (post-communistic). Mortality differentiation among frormer socialist countries of Europe is very considerable and continues to be quite problematic. We can say that most of the post communist countries (for example: Baltic States) by the end of the 80's to mid 90's underwent major problems, which in turn could negatively affect the demographic situation.

It is important to know that there are many factors contributing to the emergence of cancer. For example high blood pressure and high cholesterol are closely linked to excessive consumption of fatty, sugary and salty foods. The impact of these factors becomes even more lethal when combined with the deadly consequences of smoking and excessive alcohol consumption, which cause various types of cancer and cardiovascular disease, stroke and other serious illnesses (Demoscope, 2002).

In the 20th century mortality development from neoplasms was typically high among males. But, over the past few decades mortality is gradually declining, while among the female population mortality patterns caused by cancer started to speedy increase. There are many different hypotheses about the causes of increased mortality among women in industrialized countries. One of the most credible reasons is the emancipation of women. We can assume that over the last fifty years years in many industrialized countries, level of equality between men and women is becoming increasingly evident. We believe that gender equality has led to massive changes in the behavior of women. For example numerous kinds of job in the recent past had been occupied exclusively by men. Currently they are being developed by women. We can not exclude that these factors influence the behavior of women, which can have a negative impact on mortality structure among women.

In order to understand which factors shape a given level of mortality we need to know how people's health changes and how this change affects on their life. Nowadays, the society can be divided into two camps, the first of them – the number of people who know and understand all kinds of negative phenomena (drinking alcohol, drug addiction and cigarette consumption) but nevertheless continue to be exposed to these influences, the second - this is a relatively smaller number of people, but who are seriously concerned and taking over all efforts to maintain and improve their health. To protect people live the European Union countries must activate the following public reactions:

- Requirement to tighten protection of the environment;
- Strengthen the individual health prevention
- Promotion of healthy lifestyles.

Table11: Mortality caused by malignant neoplasms in selected years, EU countries, males, standardized death rates(per 100 000 persons, WHO European Population Standard)

Countries	Males											
	Malignant neoplasms						Index (%)					
Western	1980	1985	1990	1995	2000	2006	1985/1980	1990/1985	1995/1990	2000/1995	2006/2000	2006/1980
Austria	288.8	273.49	271.9	254.3	235.8	212.3	95	99	94	93	90	74
Belgium	324.3	324.88	307.6	302.6	…	235.3	100	95	98	…	…	73
Denmark	256.9	278.82	254.2	274.9	260.4	245.5	109	91	108	95	94	96
Finland	253.1	258.33	242.9	220.6	198.5	183.9	102	94	91	90	93	73
France	306.8	312.60	305.0	287.9	270.0	242.6	102	98	94	94	90	79
Greece	205.1	217.55	215.5	223.2	222.8	207.4	106	99	104	100	93	101
Ireland	253.7	267.67	269.7	268.3	251.4	218.7	106	101	99	94	87	86
Italy	274.0	291.59	291.3	275.4	256.8	223.5	106	100	95	93	87	82
Netherlands	311.7	311.91	301.2	287.2	261.5	234.6	100	97	95	91	90	75
Portugal	212.2	214.85	221.0	225.3	223.2	216.2	101	103	102	99	97	102
Spain	222.3	244.04	261.1	268.9	248.9	232.8	110	107	103	93	94	105
Sweden	197.9	202.61	199.5	190.9	186.1	178.3	102	98	96	98	96	90
United Kingdom	287.0	288.76	278.7	260.9	237.8	215.6	101	97	94	91	91	75
post-communist												
Bulgaria	173.3	187.8	196.8	209.1	192.6	224.5	108	105	106	92	117	129
Czech Republic	336.2	346.7	358.7	343.8	325.4	284.2	103	103	96	95	87	85
Estonia	270.3	283.9	286.1	313.4	299.2	302.1	105	101	110	95	101	112
Hungary	317.3	334.4	372.9	389.4	394.2	330.9	105	112	104	101	84	104
Latvia	247.5	267.5	288.1	295.1	286.3	299.4	108	108	102	97	105	121
Lithuania	244.3	255.2	283.0	303.6	295.1	299.5	104	111	107	97	101	123
Poland	265.1	287.5	299.5	305.3	304.5	293.6	108	104	102	100	96	111
Romania	191.8	189.4	190.0	205.4	223.0	240.8	99	100	108	109	108	126
Slovakia	265.7	282.2	314.0	324.6	326.6	301.5	106	111	103	101	92	113
Slovenia	…	300.5	294.6	304.1	294.2	277.4	…	98	103	97	94	…

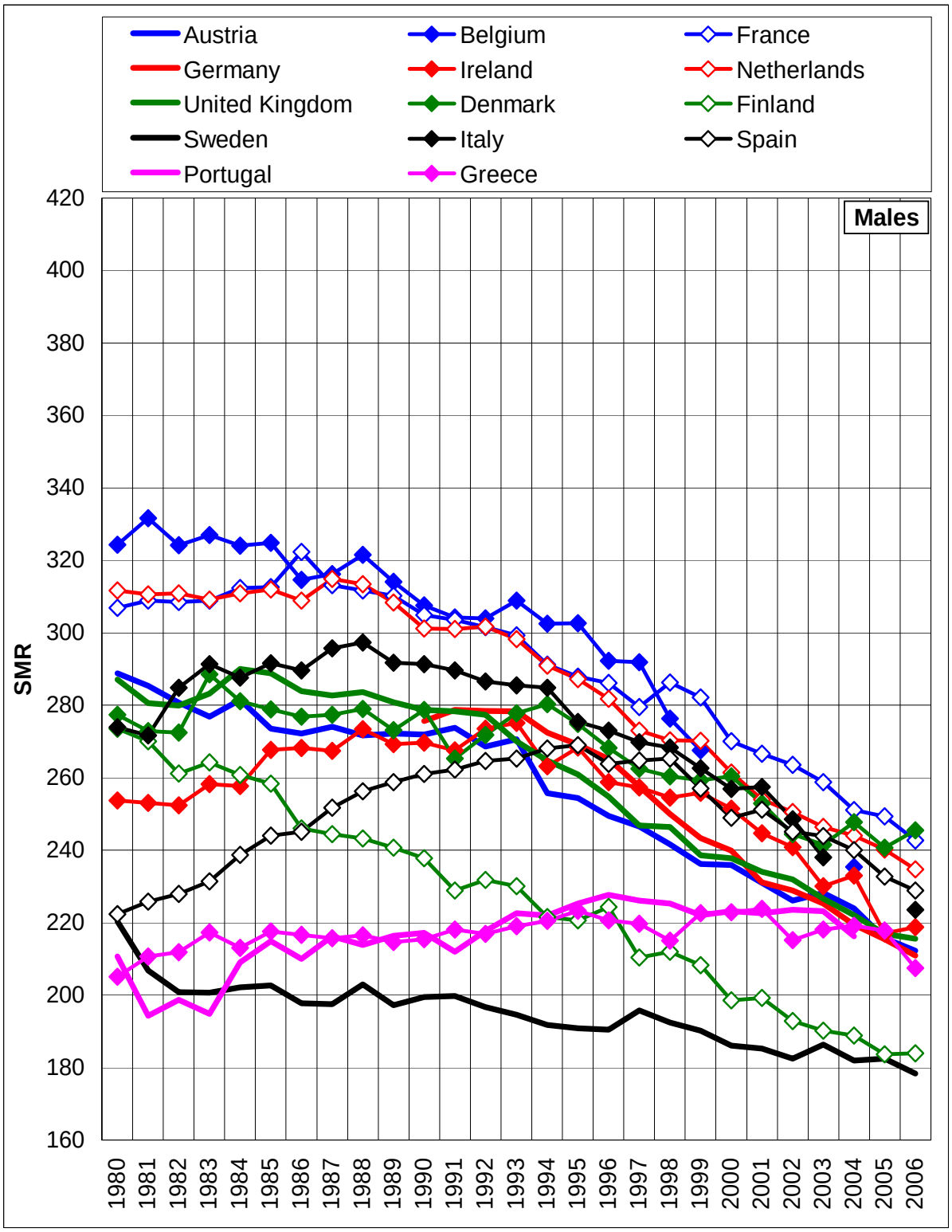
Source: Author's own calculation based on data from WHO mortality database

Table12: Mortality caused by malignant neoplasms in selected years, EU countries, females, standardized death rates(per 100 000 persons, WHO European Population Standard)

Countries	Females											
	Malignant neoplasms						Index (%)					
Western	1980	1985	1990	1995	2000	2006	1985/1980	1990/1985	1995/1990	2000/1995	2006/2000	2006/1980
Austria	176.4	169.5	164.4	156.7	145.1	127.5	96	97	95	93	88	72
Belgium	169.8	162.8	155.4	155.7	…	130.8	96	95	100	…	…	77
Denmark	188.0	200.8	201.4	209.4	197.9	182.1	107	100	104	95	92	97
Finland	140.8	137.9	136.9	130.2	124.9	113.4	98	99	95	96	91	81
France	142.7	137.8	133.6	130.3	124.3	112.2	97	97	98	95	90	79
Greece	117.1	117.9	113.3	115.0	114.7	111.0	101	96	101	100	97	95
Ireland	185.4	180.6	182.9	179.3	177.0	159.8	97	101	98	99	90	86
Italy	145.7	150.2	148.2	143.6	138.0	122.6	103	99	97	96	89	84
Netherlands	163.1	165.6	165.8	163.0	157.9	154.3	102	100	98	97	98	95
Portugal	128.7	124.6	129.1	125.2	119.6	110.8	97	104	97	96	93	86
Spain	120.3	120.6	123.6	122.0	110.1	103.3	100	102	99	90	94	86
Sweden	159.6	147.3	144.2	142.3	138.9	135.3	92	98	99	98	97	85
United Kingdom	183.7	190.5	187.7	176.9	164.6	153.7	104	99	94	93	93	84
post-communist												
Bulgaria	111.8	122.6	117.1	123.1	116.9	124.2	110	96	105	95	106	111
Czech Republic	180.9	181.2	191.8	190.0	177.4	163.2	100	106	99	93	92	90
Estonia	139.2	142.5	143.7	143.9	150.8	143.4	102	101	100	105	95	103
Hungary	191.7	188.7	197.3	203.2	201.2	172.7	98	105	103	99	86	90
Latvia	134.6	144.8	142.3	142.4	138.8	145.5	108	98	100	97	105	108
Lithuania	130.0	137.5	138.4	144.7	142.4	133.4	106	101	105	98	94	103
Poland	153.4	155.0	156.0	158.2	158.9	154.9	101	101	101	100	97	101
Romania	124.1	118.2	117.6	123.4	129.6	132.6	95	99	105	105	102	107
Slovakia	144.3	145.6	148.5	150.2	156.6	145.7	101	102	101	104	93	101
Slovenia	156.8	156.8	155.4	164.3	149.0	145.4	100	99	106	91	98	93

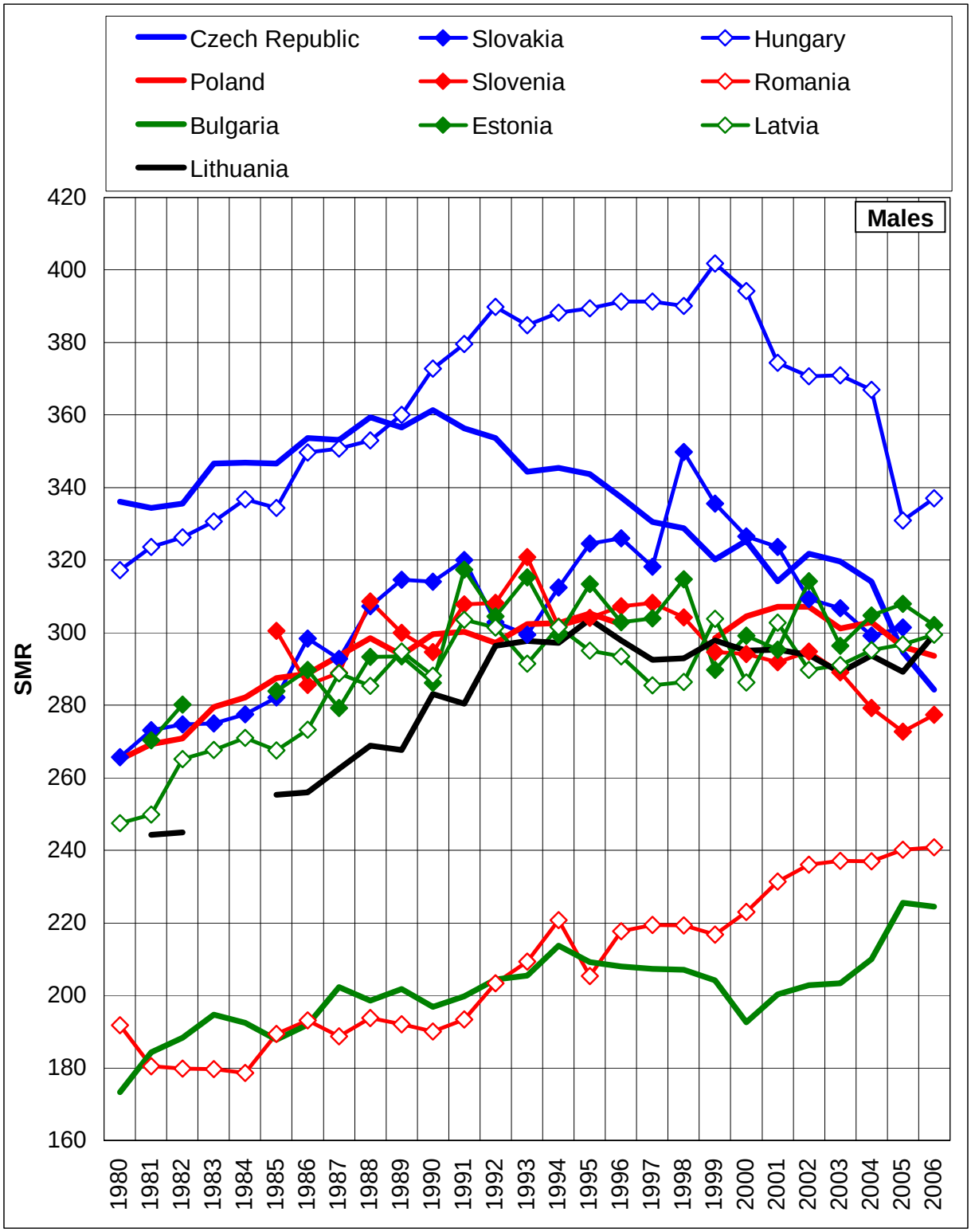
Source: Author's own calculation based on data from WHO mortality database

Fig. 11- Mortality caused by malignant neoplasms, Western European countries, 1980-2006, males, standardized death rates, (per 100 000 persons, WHO European Population Standard)



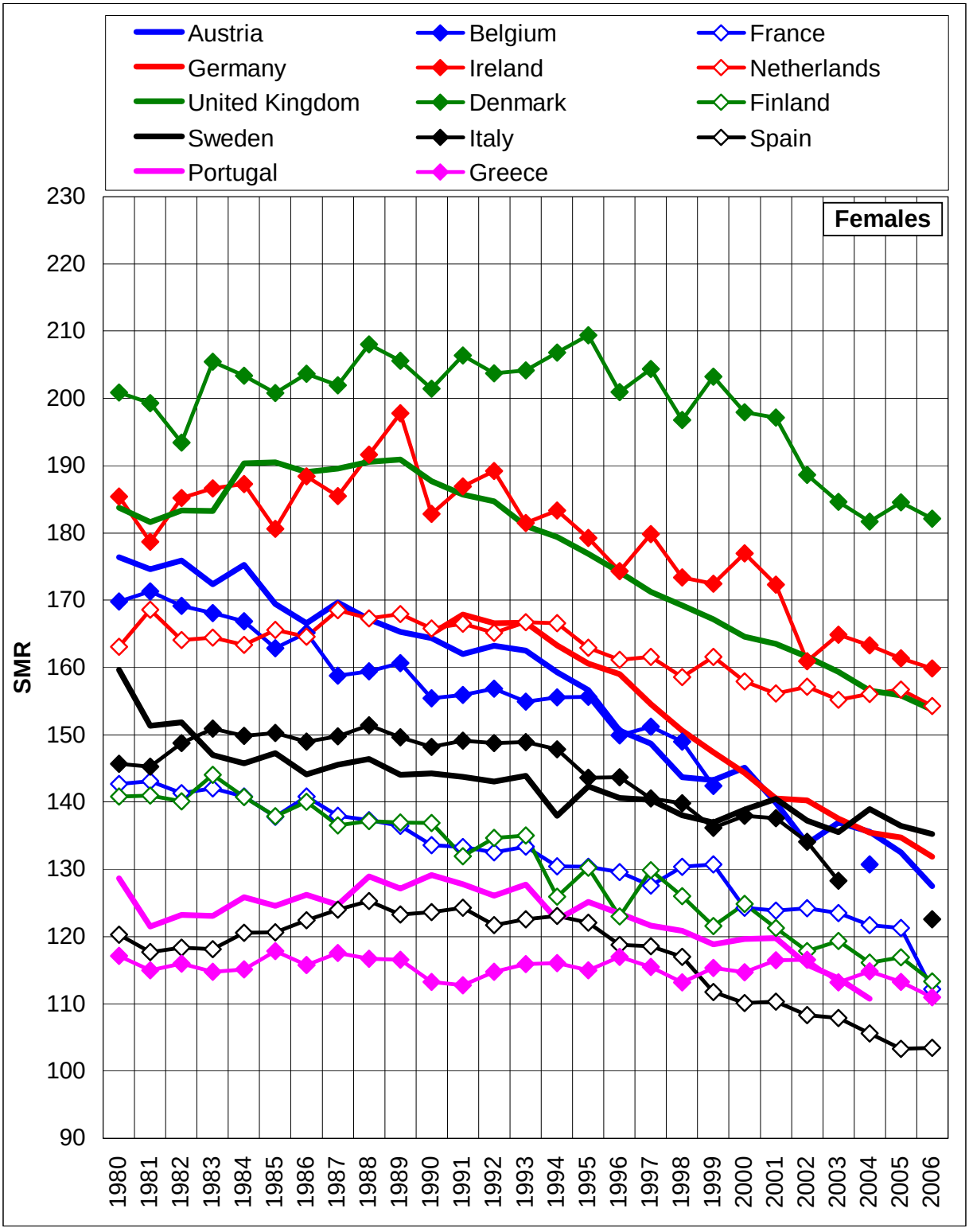
Source: Author's own calculation based on data from WHO mortality database

Fig. 12-Mortality caused by malignant neoplasm, post-communist European countries, 1980-2006, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



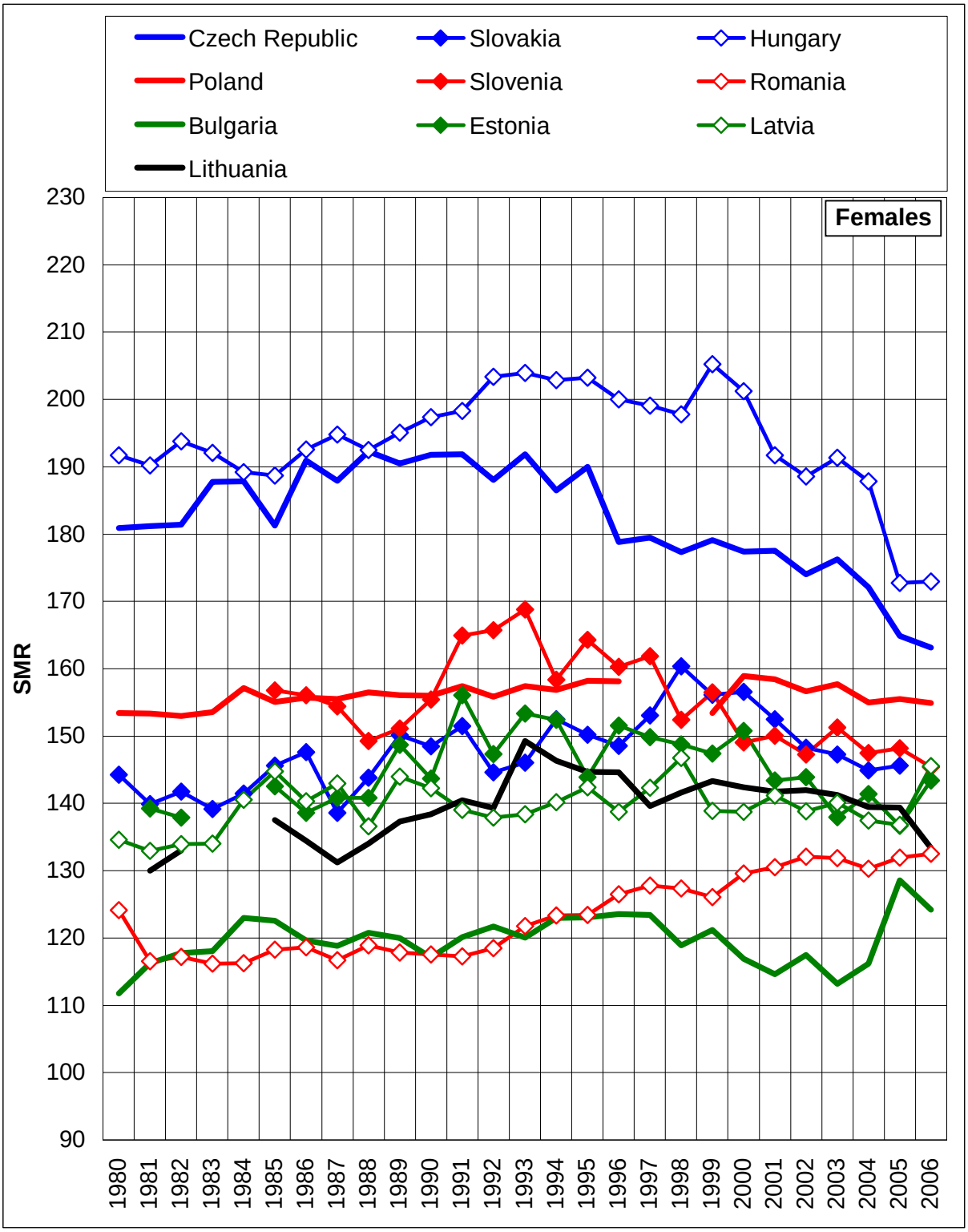
Source: Author's own calculation based on data from WHO mortality database

Fig. 13- Mortality caused by malignant neoplasms, Western European countries, 1980-2006, females, standardized death rates, (per 100 000 persons, WHO European Population Standard)



Source: Author's own calculation based on data from WHO mortality database

Fig. 14- Mortality caused by malignant neoplasm, post-communist European countries, 1980-2006, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Source: Author's own calculation based on data from WHO mortality database

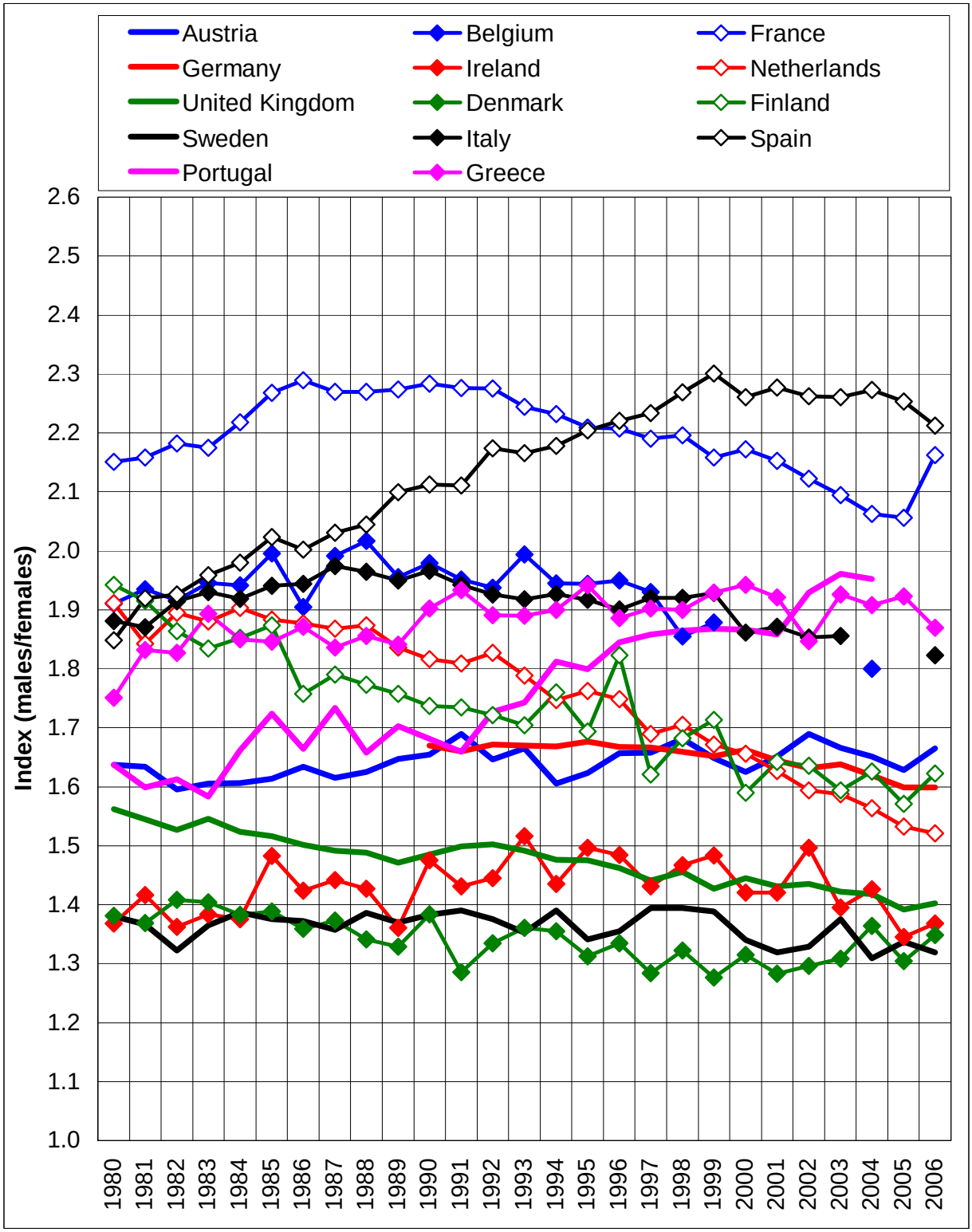
According to Figure 11 it can be noted that mortality development from neoplasms was the most common among Western European countries. Extremely high mortality rate was observed in Belgium, the Netherlands, France, United Kingdom, Italy, Denmark and Austria. One of the most striking examples is the Netherlands. From 1980 to 2006 mortality significanlty decreased (311 to 234 deaths per 100 000 men) among Dutch males. Mortality from neoplasms was significantly low in Finland, Greece and Portugal. One of the lowest death rates was recorded in Sweden (182-178 deaths per 100 000 men).

Figure 12 illustrates mortality trends of the male population in post-communist European countries. Throughout the entire period mortality development from neoplasms was the highest in Hungary (401 deaths per 100 000 men). Moreover, mortality was significantly high among the Czech and Slovakian males. It can be seen that mortality among the male population was very intense in Slovenia and the Baltic States. The lowest death rates of the males were recorded in Bulgaria and Romania. In contrast to West European countries where the death rates of the male population were gradually declining, post communist countries faced an intensive growth.

Figure 13 shows that mortality development among females was significantly heterogeneous in West Eropean countries. Extremely high level of deaths was recorded in 1995 among Danish women (209 deaths per 100 000 women). Also, mortality rates from neoplasms were significantly high in Ireland and the United Kingdom. One of the most sound example is Greece where mortality was less than 120 deaths per 100 000 women throughout the entire period. In addition, mortality patterns were considered low in Spain and Portugal. It is important to note that from 1980 to 2006 mortality development of the female population significantly changed. It was gradually declining in almost all the European Union countries.

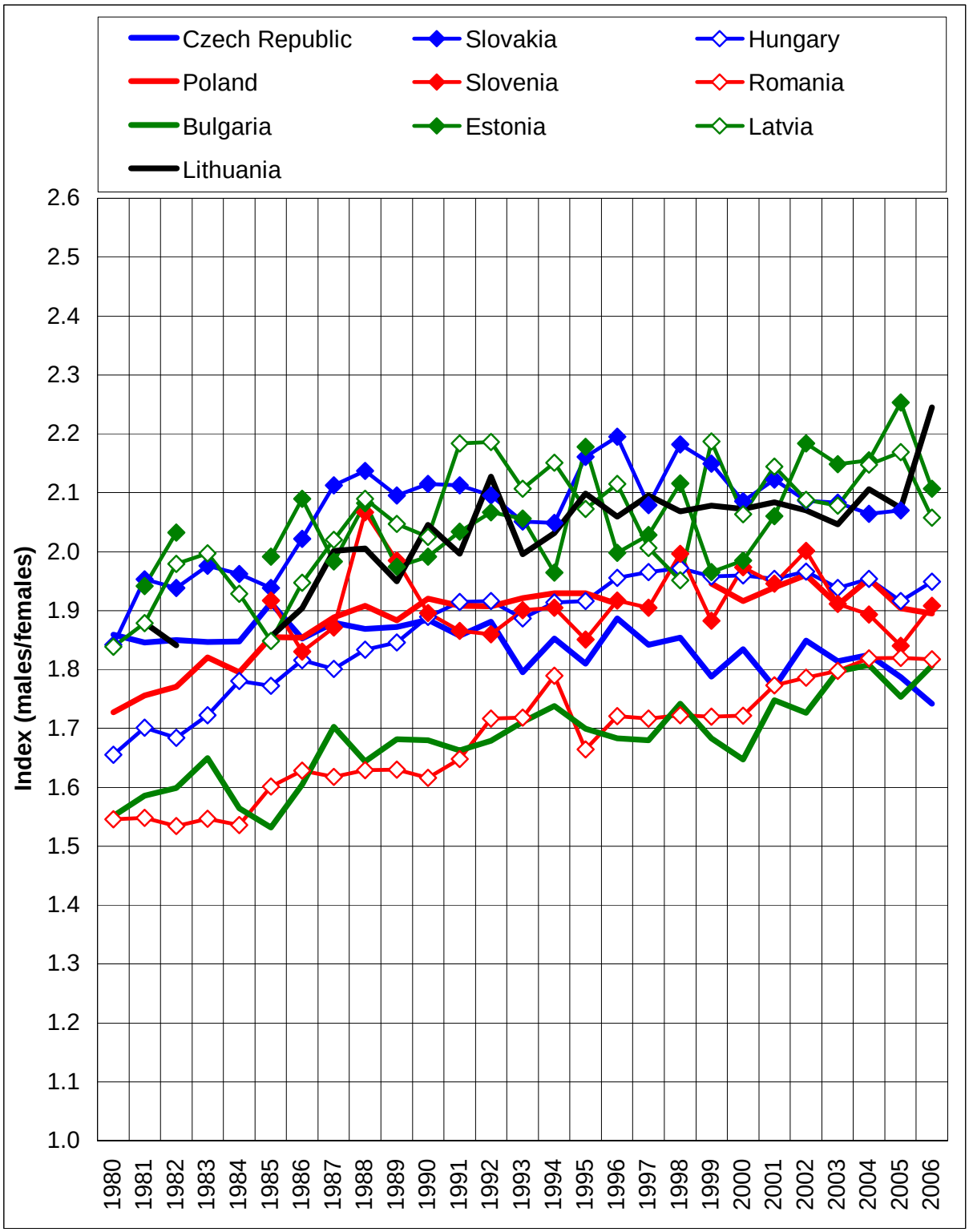
The results obtained from Figure 14 show that mortality patterns of women were very different across the post communist European countries. Three distinct trends can be observed. Firstly, Hungary and the Czech Republic have to be defined. Mortality development from neoplasms in these countries was extremely high in contrast to other countries. One of the most critical levels of mortality was recorded in Hungary during the period from 1992 to 1999 (205 deaths per 100.000 women). Secondly, development of cancer mortality which was observed in Slovenia, Slovakia, Latvia, Lithuania and Estonia was comparatively higher than in Romania and Bulgaria but less than in Hungary. The highest fluctuation was recorded in 1992 among Slovenian women (168 deaths per 100 000 women). The third group of countries includes Romania and Bulgaria. From 1981 and 1993 mortality patterns of the female population was quite similar in both countries. Substantial differences were observed from 1995, death rates in Bulgaria started to increase, while in Romania it changed in a positive direction.

Fig. 15-Index of mortality changes caused by malignant neoplasms, Western European countries, 1980-2006, males and females



Source: Author's own calculation based on data from WHO mortality database

Fig. 16-Index of mortality changes caused by malignant neoplasms, post-communist European countries, 1980-2006, males and females



Source: Author's own calculation based on data from WHO mortality database

According to Figure 15, it can be noted that mortality development from neoplasm for both sexes was very intense in France and Spain. Mortality patterns in Belgium, Greece and Italy were comparatively lower than in France, but higher than in other Western European countries. The most striiking example was recorded in Denmark, Ireland, Sweden and the United Kingdom. Mortality from malignant neoplams was gradually reducing in all the countries except France and Spain. The most significant reduction was recorded among Dutch and Finnish people.

Figure 16 shows that mortality patterns seemed to be homogeneous in most of the post-communist European countries. Mortality from cancer was intensively high in the Baltic States. Also, significantly high indeces of male and female mortality were found in such countries as Slovakia, Hungary and Poland. Mortality patterns among Czech people were significantly intense in 1990^{s}, but in the later study period a favourable reduction can be observed. The development of cancer mortality in Bulgaria was recorded significantly low.

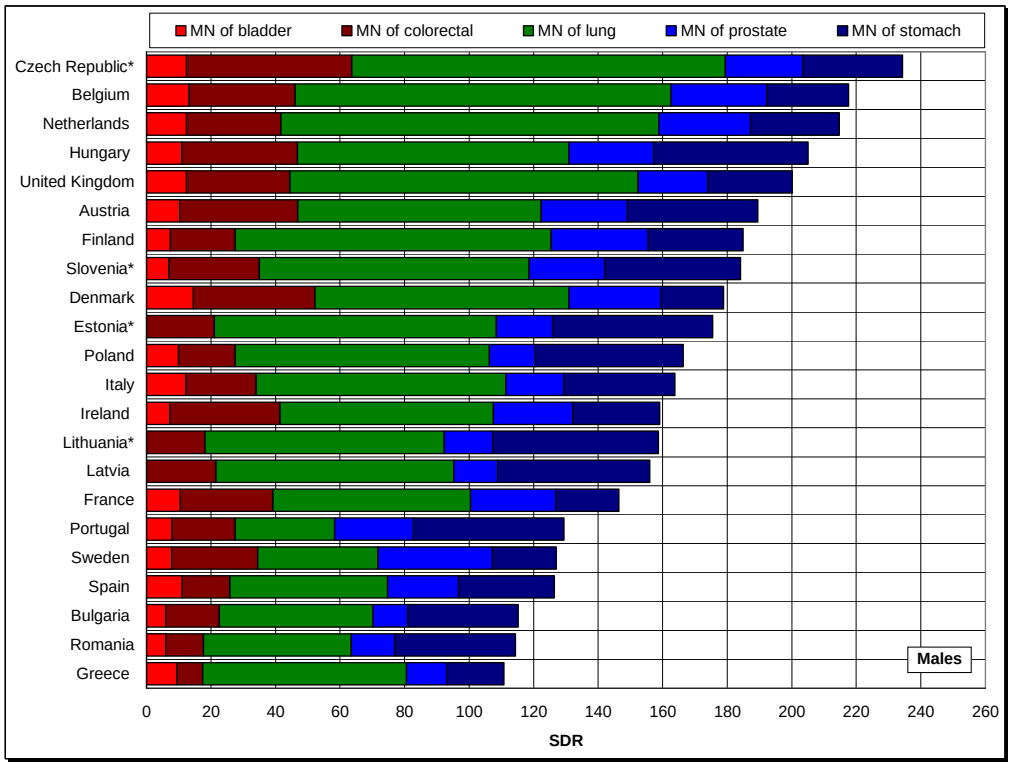
Based on the above analysis, substantial differences among West and East European countries can be revealed. In most of the West European countries cancer mortality is still declining, while in the former socialist countries mortality continued to be much more intense and less favorable.

7.3. Mortality from the most frequent malignant neoplasms

This part aimed to identify comprehensive information about mortality development from the most frequent neoplasms. Malignant neoplasms are still major and dramatically increasing causes of death throughout the European Union countries. There are significant differences in mortality trends among the West and former socialist countries of Europe. These can be partially explained by differences in cancer risk factors, lifestyle-related and environmental, including tobacco smoking, alcohol, dietary habits and pollution. Moreover, many differences have their roots in social and economic inequalities as a consequence of political systems and reforms that existed among various geopolitical regions in Europe. It is important to note that political and economic transformation in former communist countries of Central and Eastern Europe has been quite difficult for countries (mainly for the Baltic Statest), which greatly influenced the growth of morbidity and mortality from various forms of cancer. In addition, the time trends in cancer mortality also vary between European Union countries and some forms of neoplasms show different trends between men and women. For example, mortality patterns caused by lung cancer substantially reduced in many countries among men (particularly the more vulnerable groups) but increasing among women, particularly the young. In other countries, (e.g. Hungary) lung cancer rates are still increasing in both sexes. Mortality patterns varied for many other form of cancer. For instance breast cancer is the disease which most frequently diagnosed among the female population of the European Union.

Over the last century, the diagnosis of cancer is often associated as a death sentence, but substantial progress in medical knowledge allowed achieving significant results in the struggle for human’s life. In particular, innovations such as screening, surgery, radiation therapy and pharmaceuticals have made it possible to offer a higher probability of cure of cancer patients.

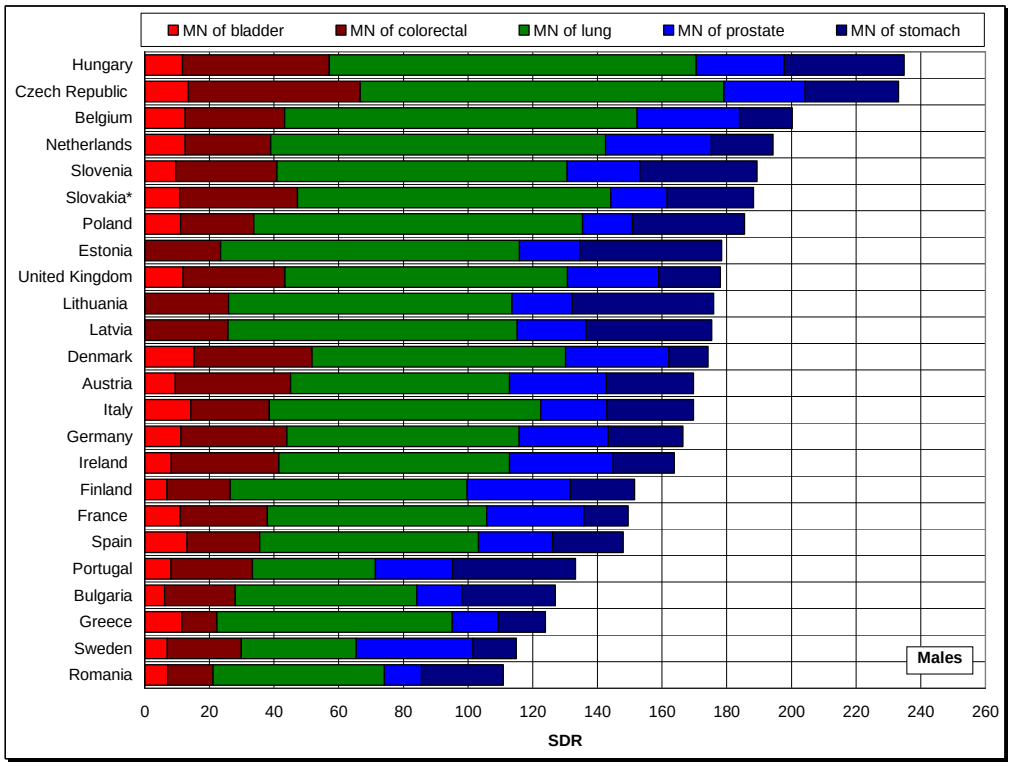
Tab 17: Mortality from the most frequent malignant neoplasm, EU countries, 1980, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: the Czech Republic 1986, Estonia 1981, Lithuania 1981, Slovenia 1985

Source: Author's own calculation based on data from WHO mortality database

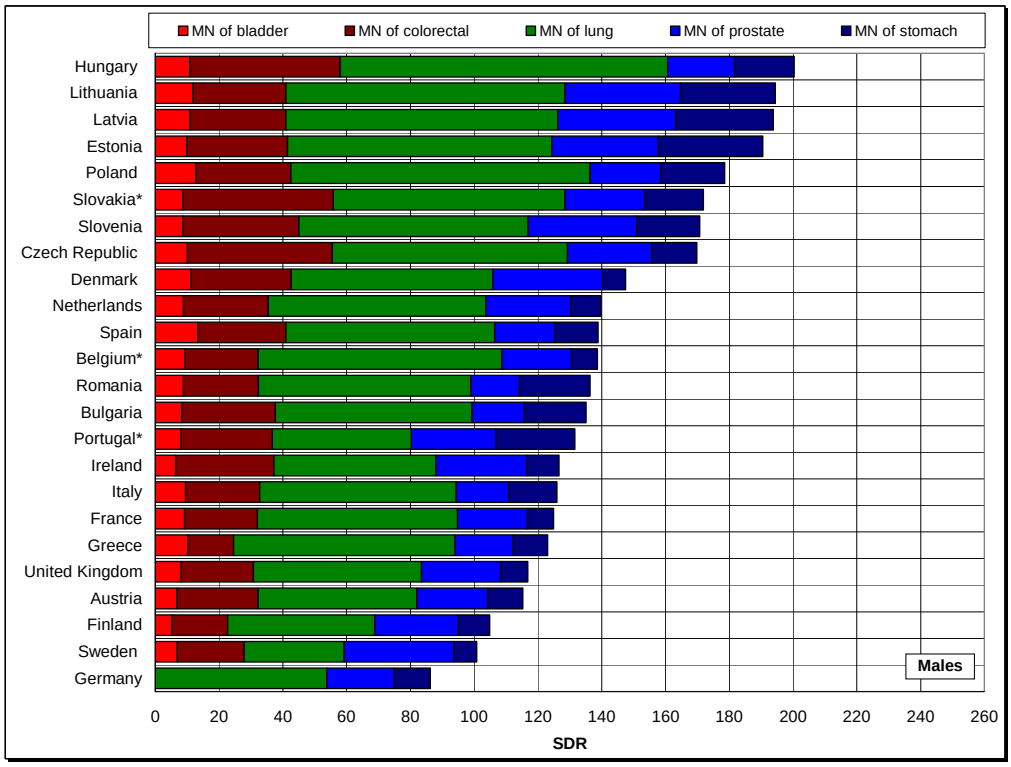
Tab 18: Mortality from the most frequent malignant neoplasm, EU countries, 1990, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Slovakia 1992

Source: Author's own calculation based on data from WHO mortality database

Tab 19: Mortality from the most frequent malignant neoplasm, in European Union, 2006, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Belgium 2004, Portugal 2003, Slovakia 2005

Source: Author's own calculation based on data from WHO mortality database

Figure 17 reveals that mortality patterns from lung cancer were the most common among other forms of malignant neoplasms in the European Union countries over the last two decades. In 1980 mortality development of the male population was the highest in the Czech Republic (115 deaths per 100 000 men). Also, death rates were singnificantly high in Belgium, the Netherlands, Hungary and the United Kingdom. In contrast to the above-mentioned countries, the lowest mortality rate was recorded in 1980 among Portuguese (30 deaths per 100 000 men). Mortality development caused by stomach cancer was the most frequent after the lung cancer. One of the highest death rate was recorded in Lithuania (51 deaths per 100 000 men). In addition, mortality rate was significantly high in Estonia, Latvia, Portugal and Poland. The lowest death rates were observed in Denmark, Spain, Sweden and Greece (17-19 deaths per 100 000 men). The third in the frequency of death among European men was colorectal cancer. Mortality rates in the Czech Republic were recorded as extremely high (51 deaths per 100 000 men), while in Greece, mortality from colorectal cancer was very low (8 deaths per 100 000 men). Regarding prostate cancer, it can be noted that mortality patterns were substantially homogenous in many countries of the European Union. The highest death rates were among Swedish men (35 deaths per 100 000 men), while the lowest were in Bulgaria (10 deaths per 100 000 men). In contrast to the above-mentioned neoplasm causes, mortality development from bladder cancer was considered low and quite similar in most of the European Union countries.

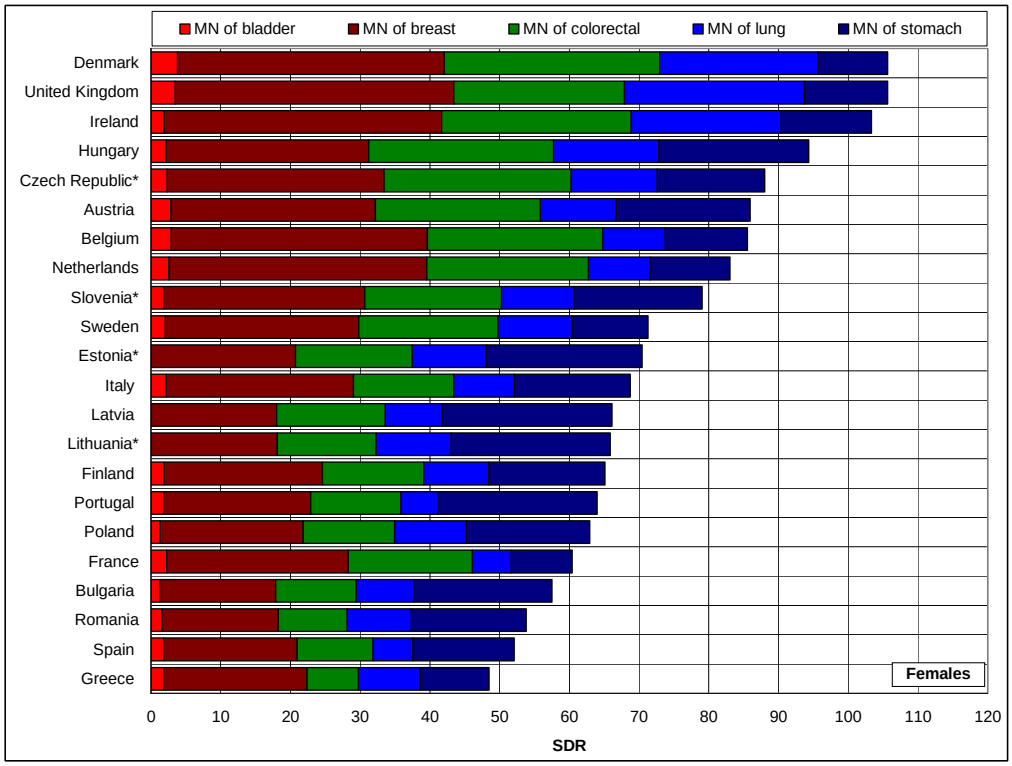
According to Figure 18, it can be seen that mortality development from lung cancer was the highest among Hungarian and Czech males (112-113 deaths per 100 000 men). The lowest death rates were recorded in Sweden and Portugal (35-38 death per 100 000 men). Regarding mortality patterns from stomach cancer, it can be said that the highest deaths rates remained in Lithuania (43 deaths per

100 000 men), while the most favorable decline was observed in Bulgaria, Sweden, France and Greece (13-14 deaths per 100 000 men). Mortality development caused by colorectal cancer remained extraordinary high in the Czech Republic (53 deaths per 100 00 men), while it was the lowest among Greek males (10 deaths per 100 000 men). Mortality patterns of prostate cancer, which were considered low and homogeneous in 1980, substantially increased in most of the European Union countries during the 1990s. The highest death rate was still prevailing in Sweden (36 deaths per 100 000 men). In contrast to the above-mentioned neoplasm causes, mortality development of bladder cancer was lower among the male population of the European Union countries.

Figure 19 shows that lung cancer mortality was significantly favorable among most of the Western European countries. It is important to note that death rates were considered low in such countries as Sweden and Finland (31-46 deaths per 100 000 men), while in most of the former communist countries it remained extraordinary high (e.g. Hungary, Poland and the Baltic States). Mortality development from stomach cancer which was high in 1980 and 1990^{s}, substantially decreased in 2006. Despite this fact, it can be determined that mortality was high across the Baltic States (29-32 deaths per 100 000 men). It should be emphasized that mortality patterns from colorectal cancer significantly reduced in Western Europe than among former communist countries. Mortality was considered unfavorably high in the Czech Republic, Hungary and Slovakia (45-47 deaths per 100 000 men).

Based on the above analysis, it can be concluded that lung cancer still remains one of the most dominant and the most frequent cause of death among the male population of the European Union countries. It has to be mentioned that the differentiation of male mortality between Western and Eastern (former communist) countries of the European Union is still a significant and problematic argument in cancer research.

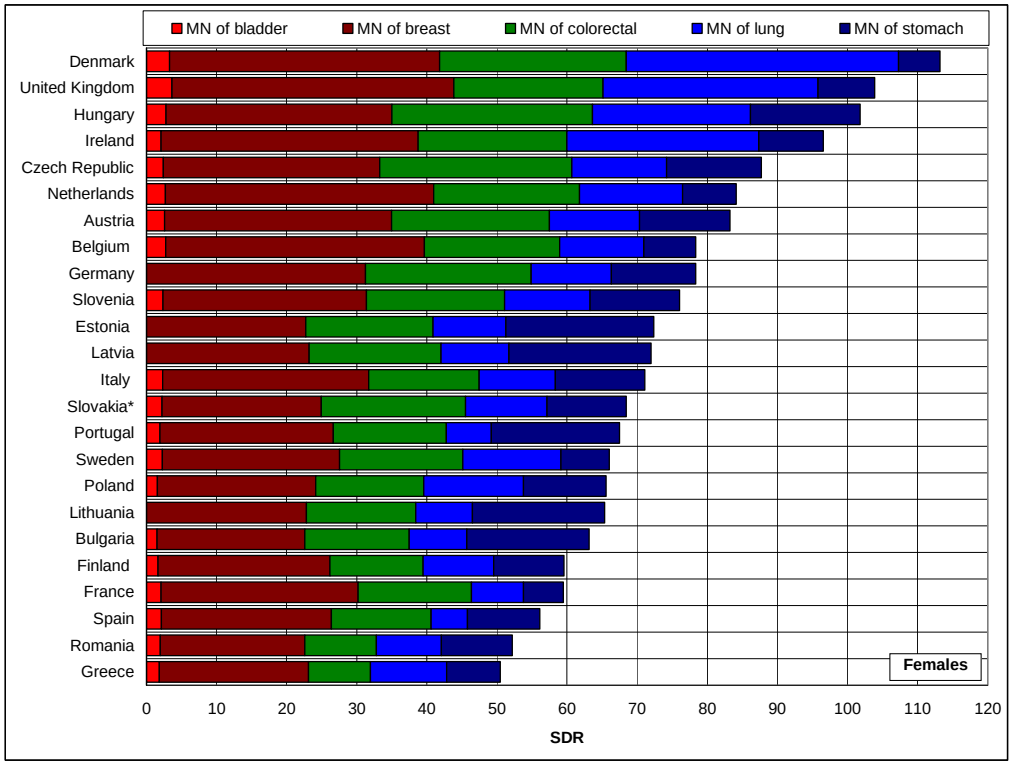
Tab 20: Mortality from the most frequent malignant neoplasm, EU countries, 1980, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: the Czech Republic 1986, Estonia 1981, Lithuania 1981, Slovenia 1985,

Source: Author's own calculation based on data from WHO mortality database

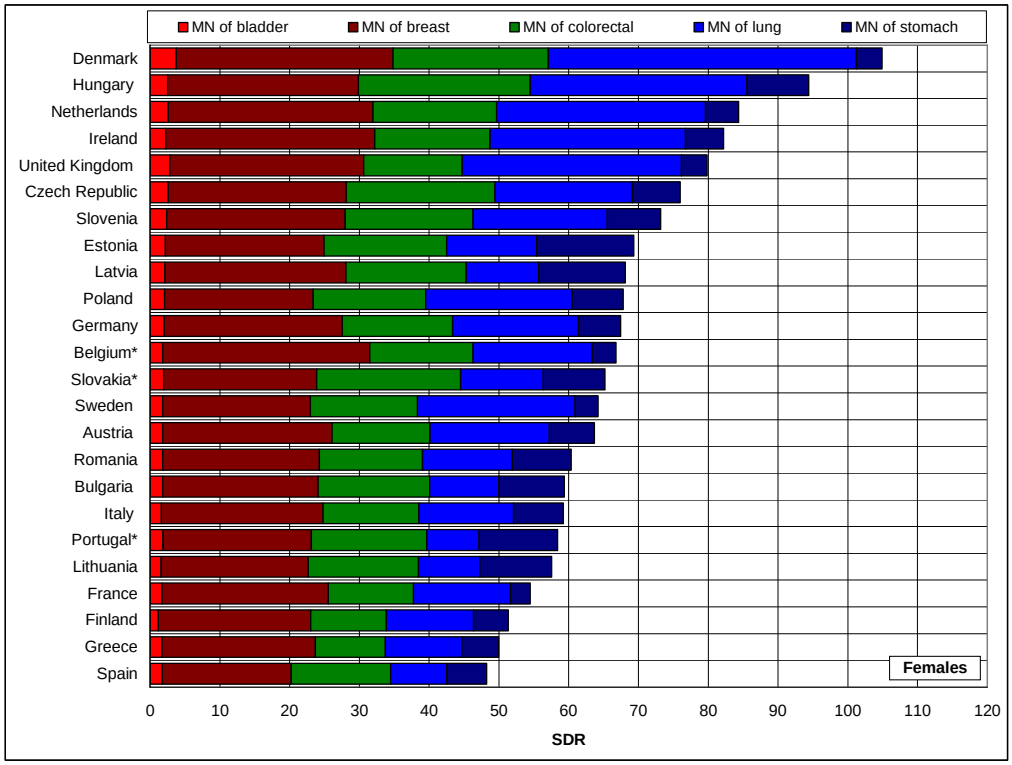
Tab 21: Mortality from the most frequent malignant neoplasm, EU countries, 1990, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Slovakia 1992

Source: Author's own calculation based on data from WHO mortality database

Tab 22: Mortality from the most frequent malignant neoplasm, EU countries, 2006, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Notes: Belgium 2004, Portugal 2003, Slovakia 2005,

Source: Author's own calculation based on data from WHO mortality database

According to Figure 20, development of breast cancer mortality in 1980 was the most frequent across Western European countries. Extremely high mortality rates were recorded in Belgium, the Netherlands, Denmark and the United Kingdom (36-40 deaths per 100 000 women). The lowest death rates were observed in Bulgaria, Romania, Latvia and Lithuania (16-18 deaths per 100 000 women). Mortality patterns from colorectal cancer were recorded at significantly high following the lung cancer. The highest mortality rate of the female population was typical for countries such as Denmark, the United Kingdom, Ireland, Hungary, the Czech Republic, Austria, Belgium and the Netherlands (23-30 deaths per 100 000 women). Regarding stomach cancer, mortality development was significantly high in Portugal and the Baltic States (22-24 deaths per 100 000 women), while among Greek and Danish women it was the lowest (9-10 deaths per 100 000 women). It is important to know that lung cancer mortality was differentiated across most of the European Union countries. Mortality rate was the highest in Denmark, Ireland and the United Kingdom (21-25 deaths per 100 000 women). In contrast to the above-mentioned neoplasm causes, mortality from bladder cancer was the lowest.

Figure 21 shows that in 1990 mortality from breast cancer cointinued to be extremely high Western Europe (e.g. Denmark, the United Kingdom, Ireland, the Netherlands and Belgium). In addition, mortality patterns significantly increased among the former communist countries (e.g. Bulgaria, Romania, Latvia and Lithuania). Mortality development from colorectal cancer among women remained quite homogeneous in many European Union countries. Despite this observations, it can be noted that the highest death rate was observed in Hungary (28 deaths per 100 000 women), while in Greece it was the lowest (8 deaths per 100 000 women). It is important to know that lung cancer mortality of the female population soared in contrast to previous years. The highest death rate was recorded in Denmark (38 deaths per 100 000 women), while it was the lowest among Spanish, French and Portuguese women (5-7 deaths per 100 00 women). Mortality patterns from stomach cancer remained homogeneous almost in all countries except Estonia and Latvia which remained at a high level.

Figure 22 illustrates significant differences in mortality development of the female population from the most frequent neoplasm causes. One of the most unfavorable changes in mortality patterns of women were observed in Denmark. The death rate from lung cancer in this country had been extraordinarily high (44 deaths per 100 000 women). The lowest death rate was observed in Portugal, Spain and Lithuania (8 deaths per 100 000 women). Although mortality from breast cancer was most frequently diagnosed in the European Union, mortality development of recent years indicates that lung cancer is becoming one of the most dominant types of malignant neoplasms among females.

7.4. Lung cancer within mortality development

Lung cancer has been a major public health problem in Europe for many years. This disease is the most frequent cause of death in males in the majority of the European Union countries and one of the most common in females. Tobacco smoking among people is still the main risk factor which contributes to the emergense of lung cancer. The aim of this subchapter is to analyze lung cancer mortality patterns and reveal the differences between West and former communist countries of Europe, with special emphasis on changes in temporal trends.

Table 13:Mortality caused by lung cancer in selected years, EU countries, males, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Males											
	Malignant neoplasm of trachea, bronchus and lung						Index (%)					
Western	1980	1985	1990	1995	2000	2006	1985/1980	1990/1985	1995/1990	2000/1995	2006/2000	2006/1980
Austria	75.4	71.4	67.7	60.7	55.5	49.7	95	95	90	91	90	66
Belgium	116.5	119.8	109.0	106.2	…	76.4	103	91	97	…	…..	66
Denmark	78.6	83.6	78.4	75.3	67.0	63.2	106	94	96	89	94	80
Finland	97.9	87.4	73.2	63.3	51.9	46.1	89	84	86	82	89	47
France	61.2	65.5	67.9	68.1	66.0	62.8	107	104	100	97	95	103
Greece	63.2	72.3	72.8	72.6	72.5	69.4	114	101	100	100	96	110
Ireland	66.1	77.4	71.3	66.9	59.5	50.8	117	92	94	89	86	77
Italy	77.5	85.2	83.9	78.8	71.2	61.6	110	99	94	90	86	79
Netherlands	117.1	116.7	103.6	94.3	78.5	68.3	100	89	91	83	87	58
Portugal	30.8	36.1	38.1	40.7	41.5	43.7	117	105	107	102	105	142
Spain	48.8	58.9	67.6	72.4	68.1	65.4	121	115	107	94	96	134
Sweden	37.2	37.2	35.6	33.6	32.3	31.3	100	96	94	96	97	84
United Kingdom	107.9	100.3	87.4	73.3	60.9	52.6	93	87	84	83	87	49
post-communist												
Bulgaria	47.7	53.5	56.2	59.4	52.4	61.72	112	105	106	88	118	129
Czech Republic	112.2	111.9	112.5	101.6	90.2	77.2	100	101	90	89	86	69
Estonia	87.4	85.9	92.4	100.8	89.5	83.0	98	108	109	89	93	95
Hungary	84.1	96.9	113.5	118.4	119.3	102.7	115	117	104	101	86	122
Latvia	73.7	83.3	89.5	87.9	80.1	85.3	113	107	98	91	106	116
Lithuania	74.2	77.1	87.6	90.6	87.3	87.5	104	114	103	96	100	118
Poland	78.8	93.0	101.7	103.8	99.9	93.8	118	109	102	96	94	119
Romania	45.8	49.2	52.9	62.8	64.9	66.6	107	108	119	103	103	145
Slovakia	79.4	89.6	97.4	95.9	87.4	72.7	113	109	98	91	83	92
Slovenia	…	83.6	89.8	90.8	74.6	72.0	…	108	101	82	96	…

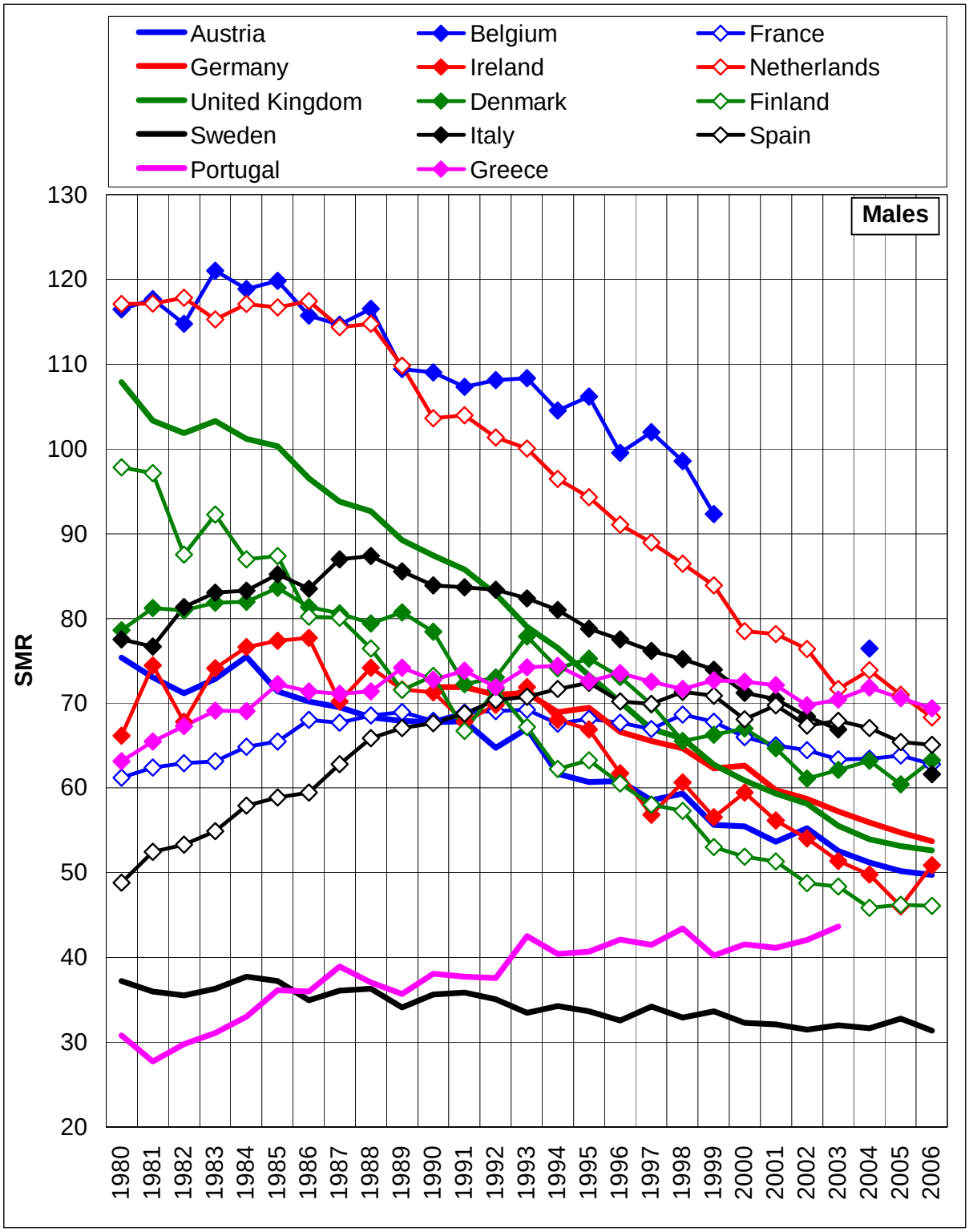
Source: Author's own calculation based on data from WHO mortality database

Table 14:Mortality caused by lung cancer in selected years, EU countries, females, standardized death rates (per 100 000 persons, WHO European Population Standard)

Countries	Females											
	Malignant neoplasm of trachea, bronchus and lung						Index (%)					
Western	1980	1985	1990	1995	2000	2006	1985/1980	1990/1985	1995/1990	2000/1995	2006/2000	2006/1980
Austria	10.9	11.9	12.9	14.1	17.0	17.1	109	108	109	120	101	156
Belgium	9.0	10.4	12.0	14.0		17.0	116	115	117	…	…	189
Denmark	22.7	31.9	38.8	40.3	40.0	44.2	141	122	104	99	110	195
Finland	9.3	10.1	10.1	10.3	11.5	12.5	108	100	103	111	109	134
France	5.5	6.4	7.4	9.0	10.5	13.9	115	116	122	116	132	251
Greece	8.9	10.4	10.9	10.6	11.2	11.0	117	105	97	106	98	124
Ireland	21.5	25.2	27.3	27.9	28.7	28.0	117	108	102	103	98	130
Italy	8.7	10.0	10.9	11.8	12.6	13.6	115	109	108	107	108	156
Netherlands	8.8	11.8	14.7	19.6	23.9	29.9	134	124	133	122	125	340
Portugal	5.3	5.7	6.4	6.9	7.4	7.5	107	113	107	107	102	142
Spain	5.7	5.5	5.2	5.8	6.7	8.7	96	95	112	115	130	152
Sweden	10.7	11.9	14.0	17.6	19.3	22.6	111	118	126	110	117	211
United Kingdom	25.8	28.9	30.7	30.7	30.1	31.4	112	106	100	98	104	122
post-communist												
Bulgaria	8.3	9.8	8.2	10.4	9.3	9.9	119	83	127	89	107	120
Czech Republic	10.1	11.8	13.5	16.8	18.2	19.7	117	115	124	108	108	195
Estonia	10.6	8.4	10.4	9.7	10.8	12.9	79	123	94	111	120	122
Hungary	15.1	16.8	22.5	26.6	31.0	31.9	111	134	118	117	103	211
Latvia	8.2	9.4	9.7	9.0	8.8	10.4	115	103	93	98	118	127
Lithuania	10.8	9.7	8.1	8.9	7.6	8.8	90	83	110	86	116	82
Poland	10.3	11.8	14.2	16.2	18.1	21.0	114	121	114	112	116	204
Romania	9.2	8.3	9.2	10.2	11.3	12.8	90	112	110	111	114	139
Slovakia	8.8	9.3	9.9	10.5	12.5	11.9	105	106	107	118	95	135
Slovenia	…	10.4	12.2	13.9	14.9	17.7	…	117	114	107	119	…

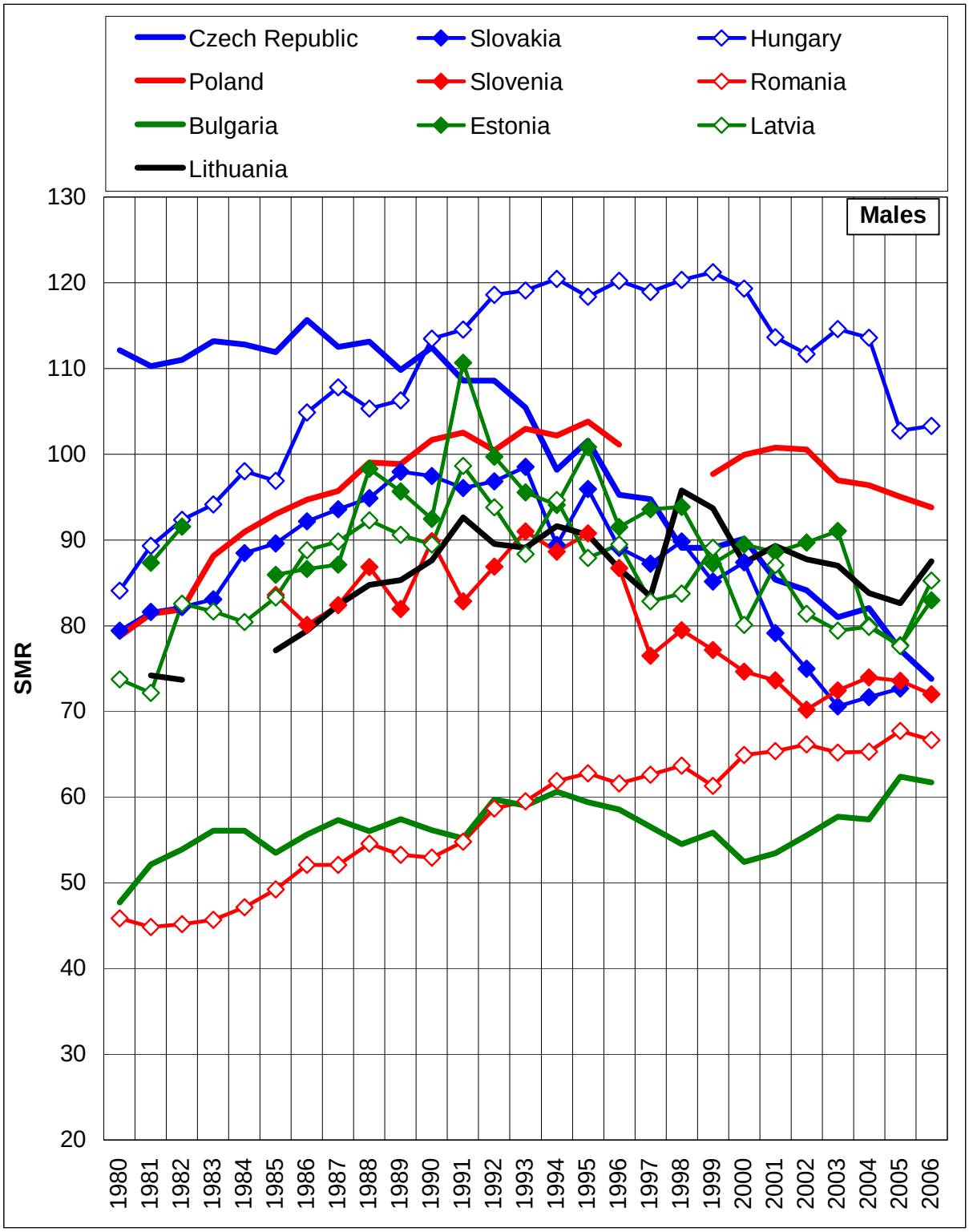
Source: Author's own calculation based on data from WHO mortality database

Fig. 23- Mortality caused by lung cancer, Western European countries, 1980-2006, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



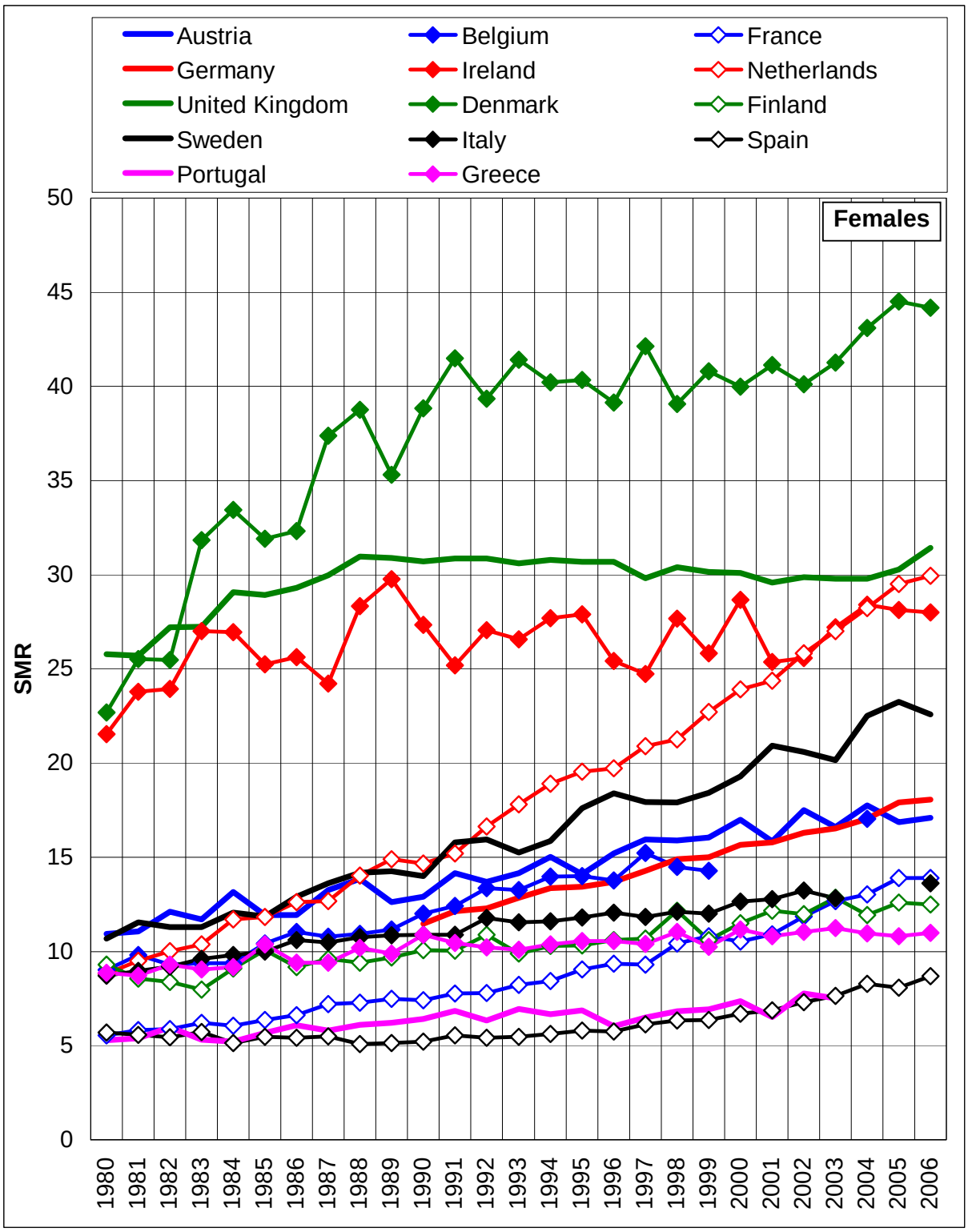
Source: Author's own calculation based on data from WHO mortality database

Fig. 24 - Mortality caused by lung cancer, post-communist European countries, 1980-2006, males, standardized death rates (per 100 000 persons, WHO European Population Standard)



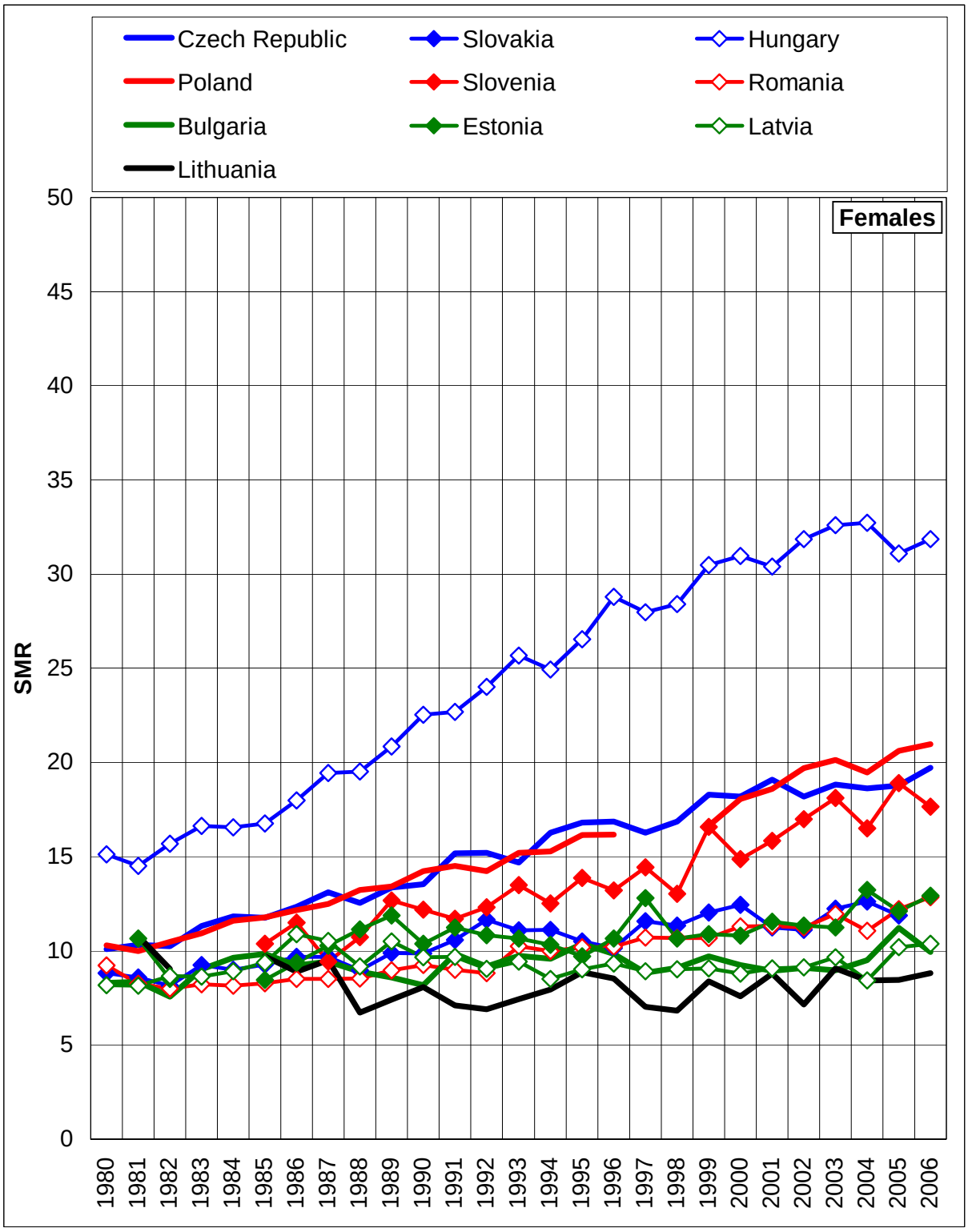
Source: Author's own calculation based on data from WHO mortality database

Fig. 25-Mortality caused by lung cancer, Western European countries, 1980-2006, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Source: Author's own calculation based on data from WHO mortality database

Fig. 26- Mortality caused by lung cancer, post-communist European countries, 1980-2006, females, standardized death rates (per 100 000 persons, WHO European Population Standard)



Source: Author's own calculation based on data from WHO mortality database

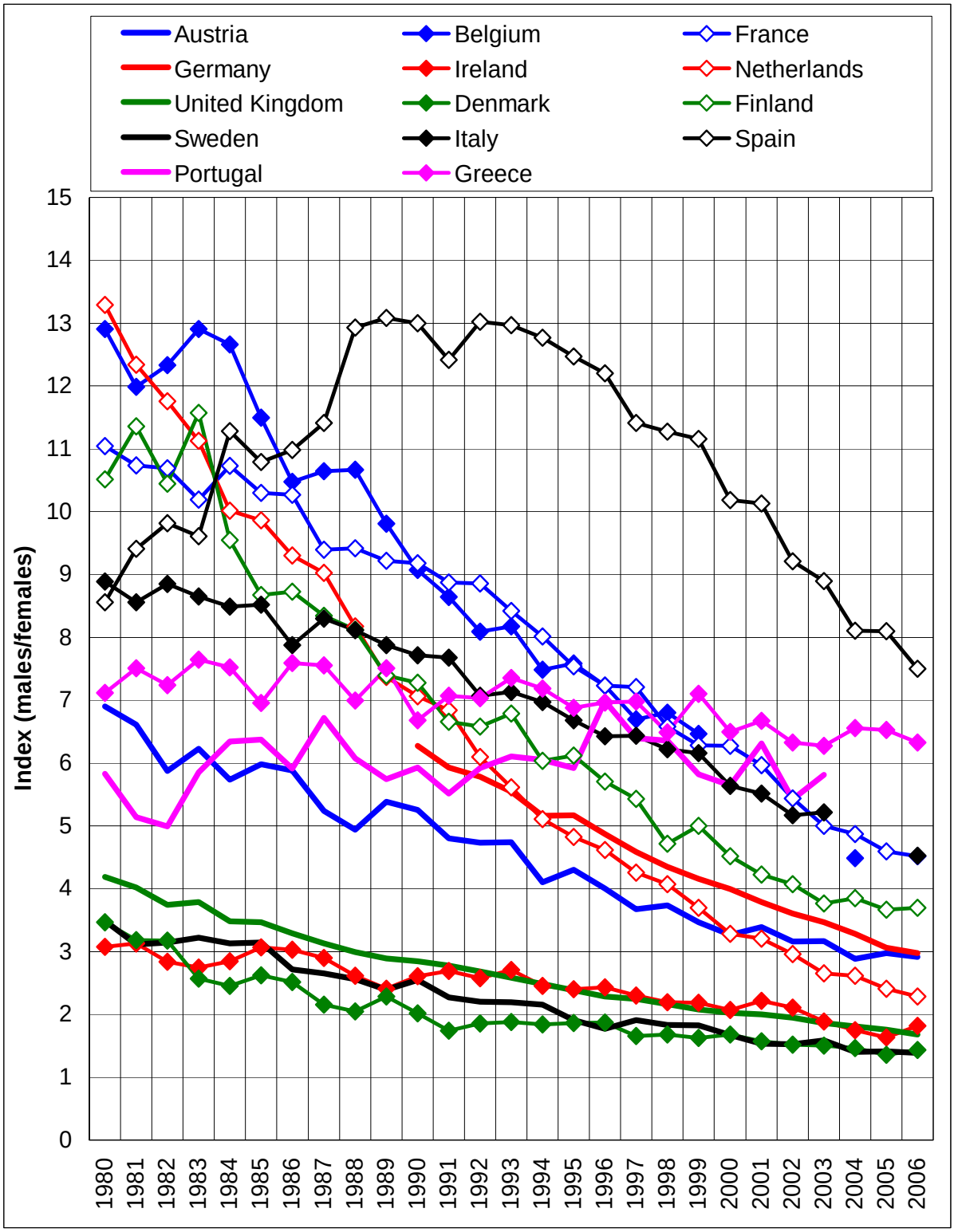
Figure 23 reveals that mortality patterns from lung cancer were significantly differentiat across Western European countries. From 1980 to 1986 mortality of the male population was extraordinary high in Belgium and the Netherlands (117-121 deaths per 100 000 men). Also, development of lung cancer mortality was significantly high in the United Kingdom and Finland (97-107 death per 100 000 men), while the lowest death rate was recorded in Portugal and Sweden (less than 45 death per 100 000 men). Throughout the entire period mortality patterns caused by lung cancer substantially deacreased in countries such as the Netherlands, the United Kingdom, Belgium and Finland. In general, since the second half of the 1980s, mortality patterns from lung cancer changed in many Western European countries, i.e. mortality was gradually deacreasing.

According to Figure 24 it can be said that development of lung cancer mortality among post communist European countries was significantly different. Throughout the entire period mortality from lung cancer was observed at an extremely high level in Hungary (121 deaths per 100 000 men). From 1980 to 1986 mortality rate was recorded as high in the Czech Republic (112-115 deaths per 100.000 men), but in the subsequent years, it was rapidly declining. It is important to note, that one of the most intensive development of lung cancer mortality was observed in Slovenia, Slovakia, Poland and the Baltic States. In comparison with the above-mentioned countries, mortality patterns were considered low among Bulgarian and Romania females (62-66 deaths per 100 000 men). Since the mid 1990^{s} lung cancer mortality of the male population changed in a favorable direction and was gradually declining almost in all the post-communist countries of Europe.

Chart 25 illustrates that lung cancer mortality of the female population in Western European countries was quite homogeneous. There are several countries (Denmark, the United Kingdom, Ireland, Netherlands and Sweden) where mortality can be considered high and intense. Development of lung cancer mortality among Danish women remains extremely high (for example from 1980 and 2006 mortality level increased from 22 to 44 deaths per 100.000 women). It is important to note that development of lung cancer mortality was recorded high in the United Kingdom, Ireland and the Netherlands. One of the most sound example of mortality patterns from lung cancer was observed in Spain and Portugal (less than 10 deaths per 100 000 men). In contrast to mortality patterns of the male population, mortality from lung cancer among women remained unfavorable and steadily growing in most of the Western European countries (e.g. Denmark, the Netherlands and Sweden).

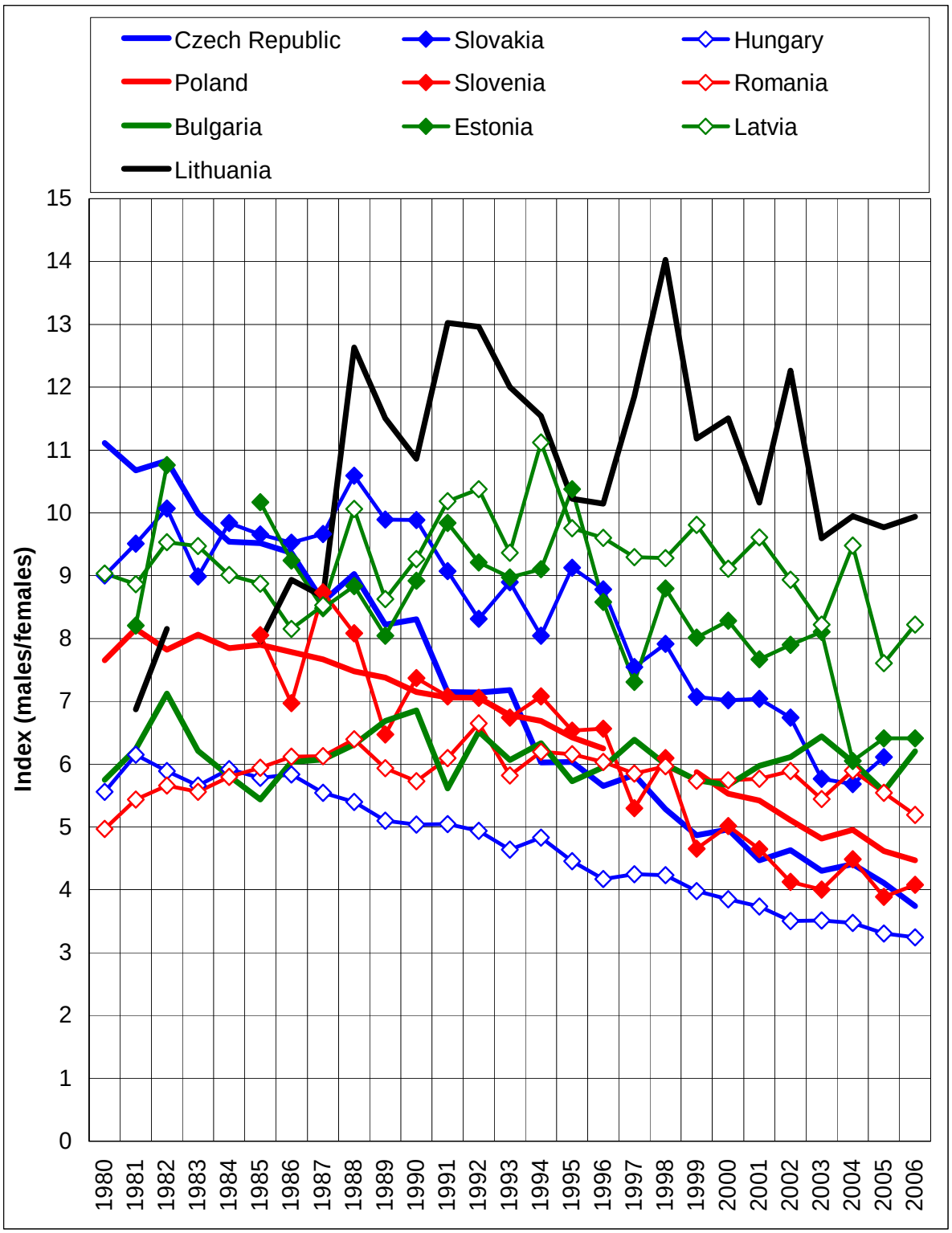
Figure 26 shows the over the past two decades lung cancer mortality rate was extraordinary high for Hungarian females. From 1980 to 2006 mortality among women increased from 15 to 31 deaths per 100 000 women. In Poland, Slovenia and the Czech Republic women's mortality rate was relatively lower than in Hungary, but it showed a significant increase. In other post communist countries (Slovakia, Bulgaria, Romania and the Baltic States) development of lung cancer mortality was significantly low and homogeneous. One of the most striking example of mortality patterns was recorded in Lithuania (10 deaths per 100 000 women).

Fig. 27-Index of mortality changes caused by lung cancer, Western European countries, 1980-2006, males and females



Source: Author's own calculation based on data from WHO mortality database

Fig. 28- Index of mortality changes caused by lung cancer, post-communist European countries, 1980-2006, males and females



Source: Author's own calculation based on data from WHO mortality database

According to the indeces of mortality change, most of the Western European countries show a different level of lung cancer mortality. Mortality patterns from lung cancer were recorded at an extremely high level in Spain throughout the entire period. Moreover, from 1980 to 1984 mortality development from lung cancer was very intensive in Belgium, France, the Netherlands and Finland. It is important to note that the increase of tobacco smoking as well as a various exogenous factors (e.g. air pollution, environmental contamination) could be the cause of high intensity in lung cancer mortality. It can be said that mortality from lung cancer in Western European countries had already passed its peak and is gradually declinig.

Among the post-communist European countries, mortality patterns from lung cancer can be considered high and very intense. The most unfavorable development was recorded in Lithuania. Moreover, lung cancer mortality fluctuated considerably in Slovakia and other Baltic States. Substantial progress in mortality reduction was observed in the Czech Republic. In contrast to Western Euope, mortality patterns due to lung cancer remained high and mostly unfavorable across former communist Europe.

It should be noted that the gender differences in lung cancer mortality continues to be quite a serious health problem in the European Union. Tobacco smoking as a major risk factor is a global threat against which people need to implement the most stringent and effective measures. Taking into account high and still growing incidence of lung cancer, the problem of prevention of the disease becomes extremely important for Europe.

7.5 Age and sex distribution by lung cancer mortality

In most of European countries considerable growth of lung cancer mortality among males and females occurred from the second half of the 20th century. At the end of 1990th lung cancer became the most extensive and frequently diagnosed form of oncological disease in the majority of European countries. Extremely high level of lung cancer mortality in European countries was caused by tobacco smoking habit. Tobacco smoking is affected by a whole variety of social, economic, cultural and behavioural determinants. Among many social changes which occurred in the 20th century in industrialized countries, smoking habits among women is the most visible. Smoking women can be considered one of the most pressing social and demographic challenges in the 21st century. In spite of high consumer demand for tobacco products in Europe, the indicators of oncological pathology (lung cancer) in females are still lower than among men, but at the same time pernicious habits of young women (smoking) remains as the most serious problem. Everyone knows that carcinogenic substances contain in tobacco smoke adversely affects the lungs, which in turn contributes to lung cancer. Lung cancer is the first among men and the second most common malignant neoplasm after the breast cancer. It may be noted that lung cancer is the most common cause of death associated with tumors. Elderly people over 65 are the most numerous populations suffering from lung cancer (Batura-Gabryel, Foremska-Iciek 2007).

The primary aim of this subchapter is to reveal what kind of age groups are the most vulnarable in terms of the lung cancer. We have separated males and females' deaths on the following age-groups: 0-44, 45-54, 55-64, 65-74, 75-84, 85+. This allows identifying which age group is the most affected in terms of lung cancer mortality.

Table.15a-f: Statistical variation by lung cancer mortality, for the period since 1980, 1990-2006, males-females in selected age-groups

a) Age-group: 0-44 b) Age-group: 45-54

	1980	1990	2006
	Male		
	EU 22	EU 24	EU 24
minimum	0.695	0.572	0.304
maximum	3.105	4.739	2.286
range	2.410	4.167	1.982
Average	1.865	1.868	0.953
St dev	0.68	0.93	0.51
Coef if var	36.3	49.6	53.8
	Female		
minimum	0.139	0.219	0.148
maximum	2.284	2.652	1.794
range	2.145	2.433	1.646
Average	0.557	0.662	0.583
St dev	0.43	0.50	0.36
Coef if var	77.2	76.2	61.6

	1980	1990	2006
	Male		
	EU 22	EU 24	EU 24
minimum	3.138	3.371	2.072
maximum	17.126	18.916	18.224
range	13.987	15.545	16.153
Average	9.400	9.738	7.259
St dev	3.34	4.15	3.68
Coef if var	35.5	42.6	50.7
	Female		
minimum	0.701	0.530	0.942
maximum	6.601	8.388	7.276
range	5.900	7.858	6.334
Average	1.808	2.038	2.715
St dev	1.29	1.58	1.50
Coef if var	71.1	77.6	55.1

Source: own calculation

According to the obtained results, it can be said that mortality patterns from lung cancer in the age group 0-44 were significantly different between males and females in the majority of the European Union countries. Mortality from lung cancer was the highest in the Czech Republic, while in Sweden it was considered low. For females, the maximum level remained high in Denmark and the lowest was observed in Latvia. In the age group 45-55, a significantly high level of male mortality from lung cancer was recorded in Hungary and the Czech Republic. Regarding women, the highest level of lung cancer mortality prevailed in Denmark and Hungary.

c) Age-group: 55-64 d) Age-groups: 65-74

	1980	1990	2006
	Male		
	EU 22	EU 24	EU 24
minimum	8.954	9.120	6.595
maximum	38.186	36.153	32.355
range	29.232	27.033	25.760
Average	22.029	23.754	18.234
St dev	7.27	8.05	6.46
Coef if var	33.0	33.9	35.4
	Female		
minimum	1.215	1.083	1.789
maximum	8.503	14.991	11.201
range	7.288	13.908	9.412
Average	3.204	3.975	5.022
St dev	1.87	2.98	2.50
Coef if var	58.4	74.9	49.8

	1980	1990	2006
	Male		
	EU 22	EU 24	EU 24
minimum	9.858	12.601	11.409
maximum	44.475	37.959	34.542
range	34.618	25.358	23.133
Average	26.082	27.002	22.817
St dev	9.52	7.53	6.56
Coef if var	36.5	27.9	28.7
	Female		
minimum	1.575	1.453	1.856
maximum	8.315	11.753	15.663
range	6.740	10.301	13.806
Average	3.418	4.276	5.307
St dev	1.65	2.59	3.33
Coef if var	48.4	60.6	62.8

Source: own calculation

In the age-group 54-65 the maximum level of lung cancer mortality of the male population was recorded in Hungary and the Czech Republic, it was at the minimum level while in Sweden. Among females, mortality was considered extraordinary high in the United Kingdom, Denmark. The lowest indices of lung cancer mortality were recorded in Portugal and Spain.

In contrast to the above- mentioned age groups, lung cancer mortality in the age-group 65-74 significantly increased for both sexes. The highest level of male mortality was observed in the Netherlands, Belgium and Poland, while it was considered low in Sweden and Portugal. Regarding female population, it can be noted that lung cancer mortality was the highest in Denmark and the United Kingdom. The lowest mortality index was recorded in France and Spain.

e) Age-group: 75-84

	1980	1990	2006
	Male		
	EU 22	EU 24	EU 24
minimum	4.472	4.040	6.416
maximum	26.90	27.004	18.779
range	22.423	22.963	12.363
Average	13.526	13.685	13.613
St dev	6.28	5.58	3.49
Coef if var	46.4	40.7	25.7
	Female		
minimum	0.985	1.101	1.238
maximum	3.663	5.776	9.263
range	2.677	4.675	8.025
Average	1.760	2.209	3.289
St dev	0.67	1.18	2.07
Coef if var	38.1	53.2	63.0

f) Age-group: 85+

	1980	1990	2006
	Male		
	EU 22	EU 24	EU 24
minimum	0.481	0.235	1.210
maximum	6.746	8.151	6.823
range	6.265	7.916	5.613
Average	2.962	3.701	3.874
St dev	1.76	2.00	1.41
Coef if var	59.5	54.1	36.4
	Female		
minimum	0.108	0.234	0.339
maximum	1.120	1.678	2.070
range	1.013	1.444	1.731
Average	0.587	0.701	1.028
St dev	0.29	0.32	0.46
Coef if var	48.8	46.3	45.2

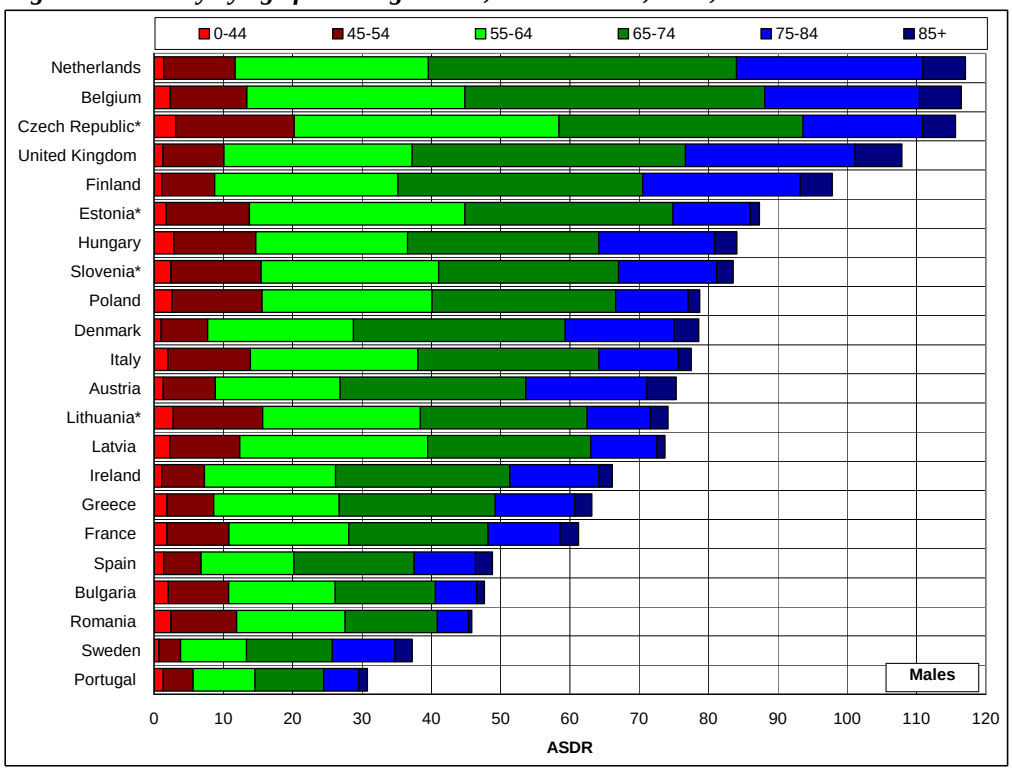
Source: own calculation

In comparison with the age-groups 54-64 and 65-74, lung cancer mortality of the male and female populations substantially decreased. Mortality level from lung cancer among males remained high in Belgium and the Netherlands. The lowest level was recorded in Romaina and Bulgaria. For females, mortality was considered high in Denmark, Ireland and the United Kingdom, while it was minimal in Portugal, Romania and Spain.

The favorable reduction of lung cancer mortality for both sexes was recorded for the last age-group (85+) in the majoriity of the European Union countries. But despite of this fact, the highest and the lowest indeces among them can be found. The maximim level of lung cancer mortality of the male population continued to be the highest in the Netherlands and the United Kingdom, while it was minimal in Romania and Bulgaria. Regarding women, mortality remained high in the United Kingdom, whereas in Estonia, Latvia and Bulgaria it was considered low.

From the analysis above, it can be conlcuded that lung cancer mortality for both sexes continued to be the highest in the age-groups 55-64, 65-74 and 75-84, that is why this form of neoplasm still remains the most common diagnosis among the elderly. Thus, it can be assumed that the probability of dying from lung cancer depends not only from tobacco smoking, but also from natural processes such as aging population, whose level is still increasing in many countries of the European Union.

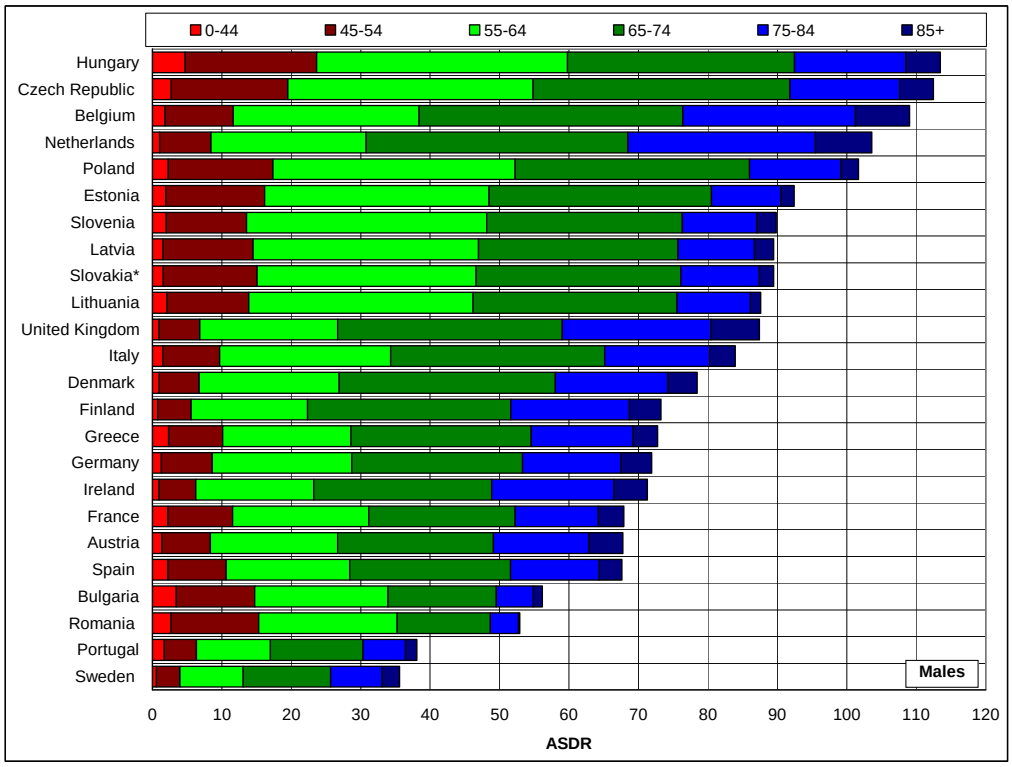
Fig. 29 - Mortality by age from lung cancer, EU countries, 1980, males



Notes: the Czech Republic 1986, Estonia 1981, Lithuania 1981, Slovenia 1985

Source: Author's own calculation based on data from WHO mortality database

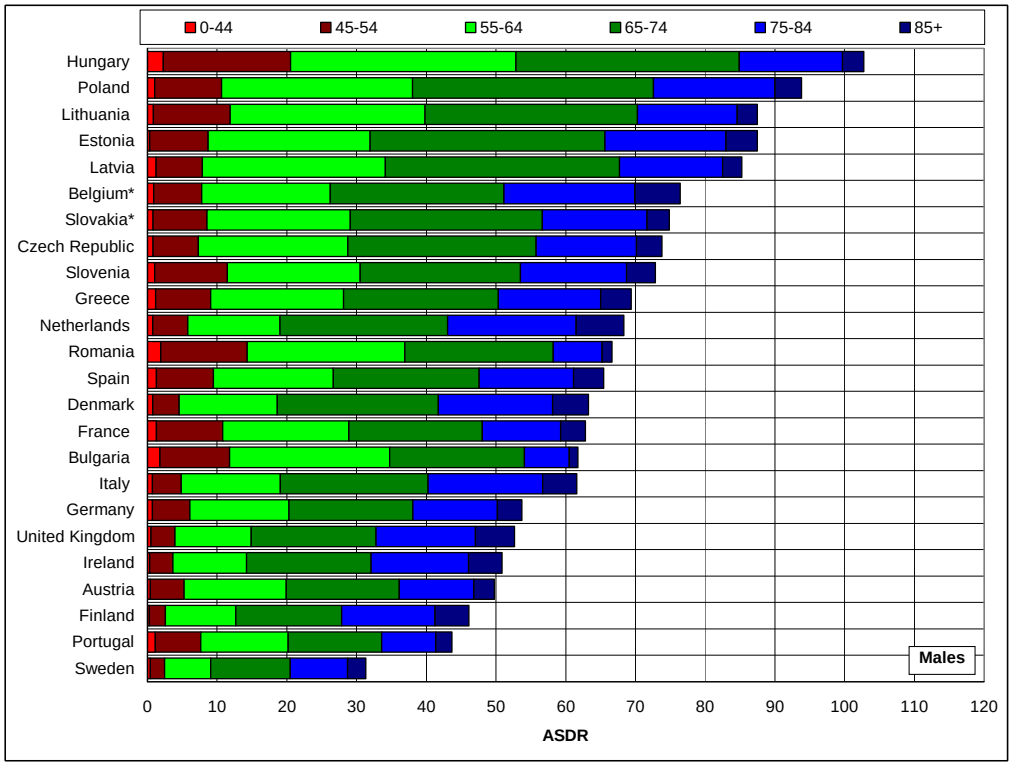
Fig. 30 - Mortality by age from lung cancer, EU countries, 1990, males



Notes: Slovakia 1992

Source: Author's own calculation based on data from WHO mortality database

Fig. 31 -Mortality by age from lung cancer, EU countries, 2006, males



Notes: Belgium 2004, Portugal 2003, Slovakia 2005

Source: Author's own calculation based on data from WHO mortality database

According to the graphical indicators, mortality patterns from lung cancer were substantially different among older people. Figure 29 shows that lung cancer mortality in the age group 65-74 was the highest in comparison with the other age groups. The highest death rate was recorded in Belgium and the Netherlands (43-44 deaths per 100 000 men), while in the lowest was observed in Portugal. In the age group 55-64 the highest mortality rate was observed in the Czech Republic (38 deaths per 100 000 men) and the lowest in Portugal and Sweden (8-9 deaths per 100 000 men). The age-group 75-84 was substantially different from above-mentioned age groups. The death rate was considered high in the Netherlands (26 deaths per 100 000 men), while it was minimal in Portugal (5 deaths per 100 000 men). In contrast to previous age-groups, lung cancer mortality was considered low in the age groups 0-44 and over 85 respectively.

Figure 30 shows that lung cancer mortality still remained high in the age-group 65-74. Mortality was significantly high in the Netherlands (37 deaths per 100 000 men) and remained low in Portugal (13 deaths per 100 000 men). It is important to note that mortality from lung cancer was the most frequent in the age groups 65-74 and 55-64. The highest death rates were recorded in most of the former communist countries (Hungary, the Chech Republic, Poland, Slovenia, Slovakia and the Baltic States). Mortality among the age-group 75-84 was considered high in the Netherlands (27 deaths per 100.000 men), while the lowest was found in Bulgaria (4 deaths per 100 000 men). Mortality patterns in the age groups 0-44, 45-54 and 85 remained low.

To conclude, it can be mentioned that lung cancer mortality of the male population was substantially different among West and the former communist European countries, but nevertheless, the mortality rate remained the most frequent and highest in the age groups 65-74 and 75-84.

Table 16: Mortality by age from lung cancer, EU countries, 1980-2006, males

Countries	1980						2006						Index					
	0-44	45-54	55-64	65-74	75-84	85+	0-44	45-54	55-64	65-74	75-84	85+	2006/1980					
Austria	1.3	7.5	18.0	26.8	17.5	4.2	0.4	4.9	14.6	16.2	10.7	2.9	31	65	81	61	61	69
Belgium*	2.3	11.1	31.4	43.2	22.4	6.0	0.9	6.9	18.5	24.9	18.8	6.5	40	62	59	58	84	109
Bulgaria	2.1	8.7	15.4	14.5	6.0	1.1	1.8	10.0	22.9	19.3	6.4	1.2	88	115	149	134	107	110
Czech Republic*	3.1	17.1	38.2	35.2	17.3	4.7	0.8	6.5	21.5	27.0	14.4	3.6	25	38	56	77	83	77
Denmark	1.0	6.7	21.0	30.5	15.7	3.6	0.8	3.8	14.1	23.1	16.4	5.1	76	56	67	76	104	142
Estonia*	1.8	12.0	31.1	30.0	11.1	1.4	0.3	8.4	23.2	33.7	17.3	4.5	18	70	75	112	156	330
Finland	1.1	7.6	26.4	35.3	22.7	4.6	0.3	2.3	10.1	15.2	13.4	4.9	27	30	38	43	59	105
France	1.9	8.9	17.3	20.0	10.4	2.7	1.3	9.5	18.1	19.1	11.2	3.5	70	106	105	95	108	133
Greece	1.8	6.8	18.1	22.5	11.5	2.4	1.2	7.9	19.0	22.2	14.6	4.4	64	117	105	99	128	181
Hungary	2.9	11.8	21.9	27.6	16.7	3.2	2.3	18.2	32.4	32.0	14.9	3.0	80	154	148	116	89	95
Ireland	1.1	6.2	19.0	25.1	12.8	2.0	0.3	3.3	10.5	17.9	14.0	4.8	29	54	56	71	109	239
Itally	2.0	11.9	24.1	26.1	11.5	1.9	0.7	4.2	14.2	21.2	16.4	4.9	35	35	59	81	143	263
Latvia	2.3	10.1	27.1	23.5	9.6	1.2	1.2	6.7	26.2	33.6	14.8	2.8	54	66	97	143	155	239
Lithuania*	2.8	12.9	22.7	24.1	9.1	2.5	0.8	11.0	27.9	30.5	14.3	2.9	30	86	123	127	156	116
Netherlands	1.4	10.3	27.9	44.5	26.9	6.1	0.8	5.1	13.2	24.0	18.4	6.8	55	49	47	54	69	111
Poland	2.6	13.0	24.6	26.5	10.4	1.7	1.1	9.6	27.4	34.5	17.5	3.8	41	74	111	130	167	224
Portugal*	1.3	4.3	9.0	9.9	5.1	1.3	1.1	6.5	12.5	13.4	7.7	2.3	86	150	140	136	152	184
Romania	2.5	9.4	15.7	13.3	4.5	0.5	1.9	12.4	22.6	21.3	7.0	1.4	77	131	144	160	156	299
Slovenia*	2.4	13.0	25.6	26.0	14.2	2.4	1.1	10.4	19.1	23.0	15.2	4.1	44	80	74	88	107	176
Spain	1.4	5.4	13.4	17.3	8.9	2.4	1.3	8.2	17.2	20.9	13.5	4.4	94	152	128	120	153	179
Sweden	0.7	3.1	9.5	12.4	9.0	2.5	0.4	2.1	6.6	11.4	8.2	2.6	60	66	69	92	91	106
United Kingdom	1.3	8.8	27.2	39.4	24.5	6.7	0.5	3.4	10.9	17.9	14.3	5.6	42	38	40	45	58	83

Notes: the Czech Republic 1986, Slovenia 1985, Estonia, Lithuania 1981, Portugal 2004,

Source:Author's own calculation based on WHO mortality databse

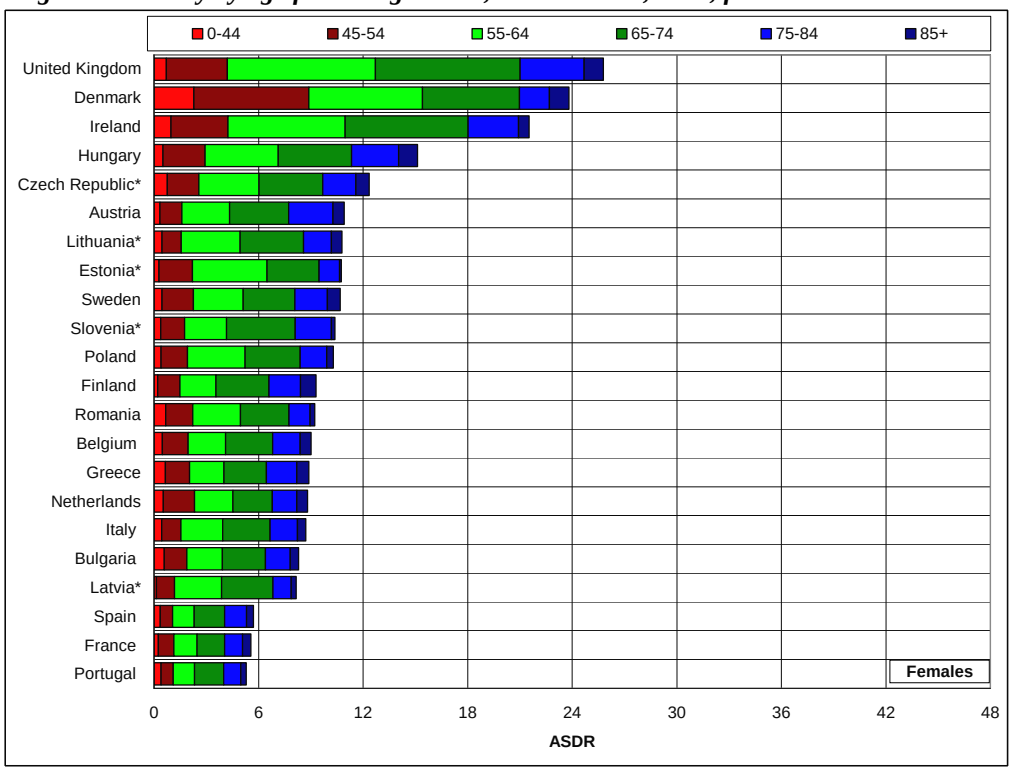
Table 17: Mortality by age from lung cancer, EU countries, 1980-2006, females

Countries	1980						2006						Index					
	0-44	45-54	55-64	65-74	75-84	85+	0-44	45-54	55-64	65-74	75-84	85+	2006/1980					
Austria	0.3	1.3	2.7	3.4	2.5	0.6	0.5	2.8	5.4	4.3	3.0	1.1	150	225	196	127	119	162
Belgium*	0.5	1.5	2.1	2.7	1.6	0.6	0.6	3.1	5.0	4.7	2.8	0.8	129	208	235	172	179	126
Bulgaria	0.6	1.3	2.0	2.5	1.4	0.5	0.9	1.6	3.3	2.3	1.4	0.3	156	125	162	95	100	70
Czech Republic*	0.8	1.8	3.5	3.6	1.9	0.8	0.4	2.6	6.1	6.2	3.1	1.4	47	142	177	169	165	178
Denmark	2.3	6.6	6.5	5.6	1.7	1.1	0.8	5.2	11.2	15.7	9.3	2.0	37	79	172	281	537	180
Estonia*	0.3	1.9	4.3	3.0	1.2	0.1	0.1	1.4	4.2	4.0	2.2	0.9	53	73	99	135	186	862
Finland	0.2	1.3	2.1	3.0	1.8	0.9	0.2	1.2	3.4	4.1	2.9	0.8	74	96	163	135	159	84
France	0.3	0.9	1.3	1.6	1.0	0.5	0.9	3.8	3.8	2.8	2.0	0.7	344	427	286	177	190	148
Greece	0.6	1.4	2.0	2.4	1.7	0.7	0.3	2.0	2.6	2.6	2.1	1.4	53	145	130	106	118	206
Hungary	0.5	2.4	4.2	4.2	2.7	1.1	1.8	7.3	9.7	7.5	3.7	1.1	347	302	230	178	138	102
Ireland	1.0	3.3	6.7	7.1	2.9	0.6	0.5	2.6	6.1	9.4	7.3	2.0	57	80	91	133	253	320
Italy	0.4	1.1	2.4	2.7	1.6	0.5	0.4	2.0	3.4	3.8	2.9	1.1	91	181	143	141	183	227
Latvia	0.1	1.0	2.7	2.9	1.0	0.3	0.2	0.9	3.0	3.3	2.3	0.7	123	91	111	111	215	244
Lithuania*	0.5	1.1	3.4	3.6	1.6	0.6	0.3	1.0	2.0	2.8	2.2	0.5	69	88	59	78	141	75
Netherlands	0.5	1.8	2.2	2.3	1.4	0.6	1.0	5.0	8.5	9.6	4.6	1.1	200	281	388	423	327	179
Poland	0.4	1.5	3.3	3.1	1.5	0.4	0.6	3.4	7.2	5.8	2.9	1.0	148	226	218	185	192	253
Portugal*	0.4	0.7	1.2	1.7	1.0	0.3	0.5	1.3	1.8	2.0	1.3	0.6	128	186	147	118	131	207
Romania	0.7	1.6	2.7	2.8	1.2	0.3	0.8	2.1	3.7	3.6	1.9	0.6	122	138	136	131	159	223
Slovenia*	0.4	1.4	2.4	3.9	2.1	0.2	0.7	3.8	4.8	4.3	2.9	1.1	189	277	196	110	141	560
Spain	0.4	0.7	1.2	1.7	1.3	0.4	0.6	1.9	1.9	1.9	1.2	0.5	170	268	157	107	99	131
Sweden	0.5	1.8	2.9	3.0	1.9	0.7	0.3	2.3	6.6	7.9	4.4	1.0	68	129	233	263	238	141
United Kingdom	0.7	3.5	8.5	8.3	3.7	1.1	0.5	2.7	7.6	10.8	7.7	2.1	71	78	89	130	211	187

Notes: the Czech Republic 1986, Slovenia 1985, Estonia, Lithuania 1981, Portugal 2004,

Source:Author's own calculation based on WHO mortality databse

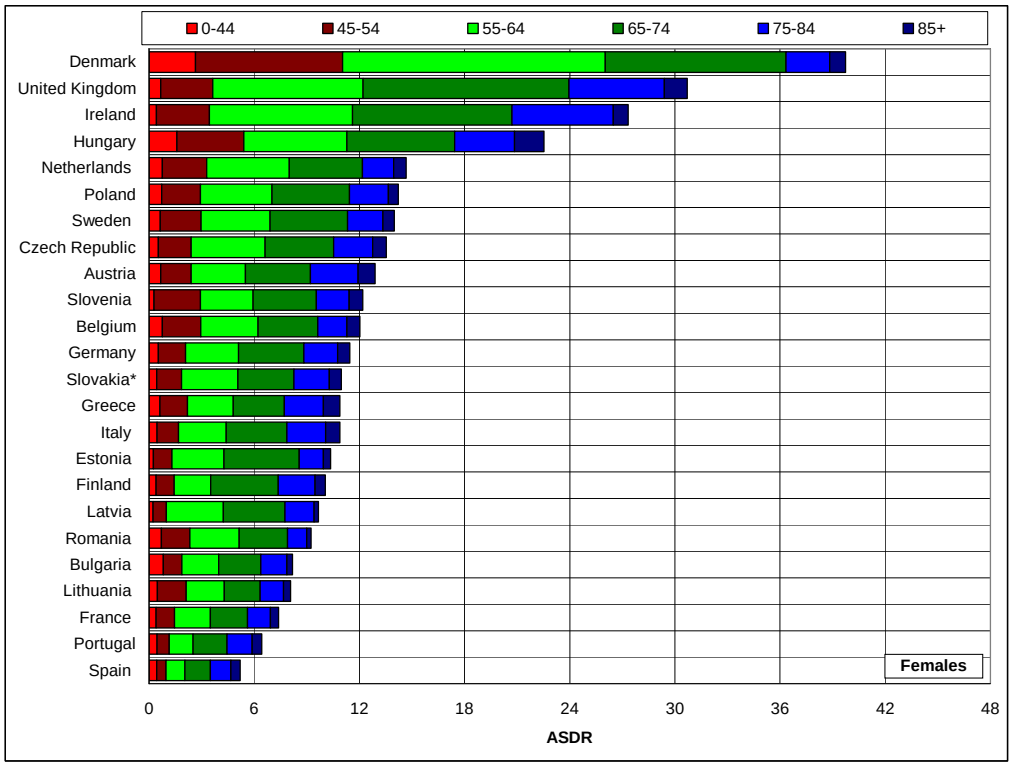
Fig. 32- Mortality by age from lung cancer, EU countries, 1980, females



Notes: the Czech Republic 1986, Estonia 1981, Lithuania 1981, Slovenia 1985

Source: Author's own calculation based on data from WHO mortality database

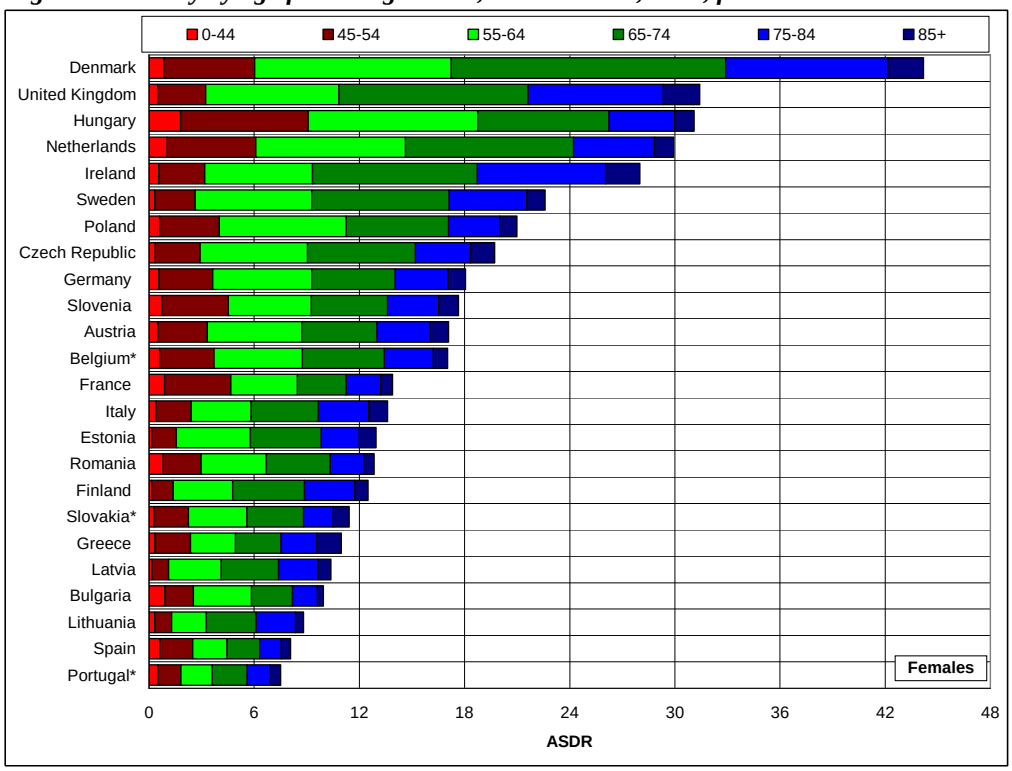
Fig. 33- Mortality by age from lung cancer, EU countries, 1990, females



Notes: Slovakia 1992

Source: Author's own calculation based on data from WHO mortality database

Fig. 34- Mortality by age from lung cancer, EU countries, 2006, females



Notes: Belgium 2004, Portugal 2003, Slovakia 2005

Source: Author's own calculation based on data from WHO mortality database

According to Figure 32 it can be seen that development of lung cancer mortality among women was significantly low and quite homogeneous almost in all European countries. Mortality of the female population was the most frequent in the age groups of 55-64 and 65-74. Mortality patterns from lung cancer were significantly high in the United Kingdom, Denmark, Ireland, Hungary and the Czech Republic, while in France, Portugal and Spain they were considered low.

Figure 33 shows that since 1990 development of lung cancer mortality soared in most of the Western European countries. For the age group 55-64 the highest mortality rate was in Denmark (14 deaths per 100 000 women), while the minimal rate was recorded in Spain. In the age-group 65-74 mortality rates were the highest in the United Kingdom (11 deaths per 100 000 women) and the lowest were in Spain. In all other age groups mortality was significantly low.

The further development of lung cancer mortality can be considered as the most unfavorable. According to Figure 34, mortality level of the female population significantly increased in most of the European countries. It is important to note that lung cancer mortality was extraordinarily high and the most frequent among Danish women. In comparison to previous age groups, mortality from lung cancer significantly increased in Austria, Belgium, Slovenia, Germany, Sweden and the Czech Republic, while in Spain and Portugal it remeined low. In the other age groups (0-44, 45-54 and 85+) mortality level caused by lung cancer was lower, but nevertheless, in Hungary, Denmark and the Netherlands deaths rates remained significantly high.

To conclude, it can be said that lung cancer affects elderly people most often. The highest rates of lung cancer mortality observed among seniors whose age is over 55 years. People younger than 45 years rarely suffer from this disease. Their share in the total mass of cancer patients is lower. Significant changes which were observed at the later stages of the epidemiological transition (for

example aging) can be directly linked to such factors as increased mortality from malignant neoplasms. Taking into account that lung cancer may develop in the middle rather than late ages, the elderly people remain to be the most vulnerable part of the population of the European countries.

It has to be mentioned, that over the past few decades lung cancer mortality among the female population increased substantially, while men's trends is gradually declining. Lung cancer is the exclusive form of neoplasm, which directly depends on smoking habits. Despite the numerous measures taken against smoking, tobacco consumption does not cease to decrease, it still remains one of the most popular and detrimental habits in some countries of the European Union (e.g. Denmark). Even in the countries where tobacco consumption is still low among women, many women's lives are already negatively affected by smoking, for example, through their husbands' spending scarce resources on cigarettes, their constant exposure to second-hand smoke and, increasingly, having to cope with a spouse's death from smoking.

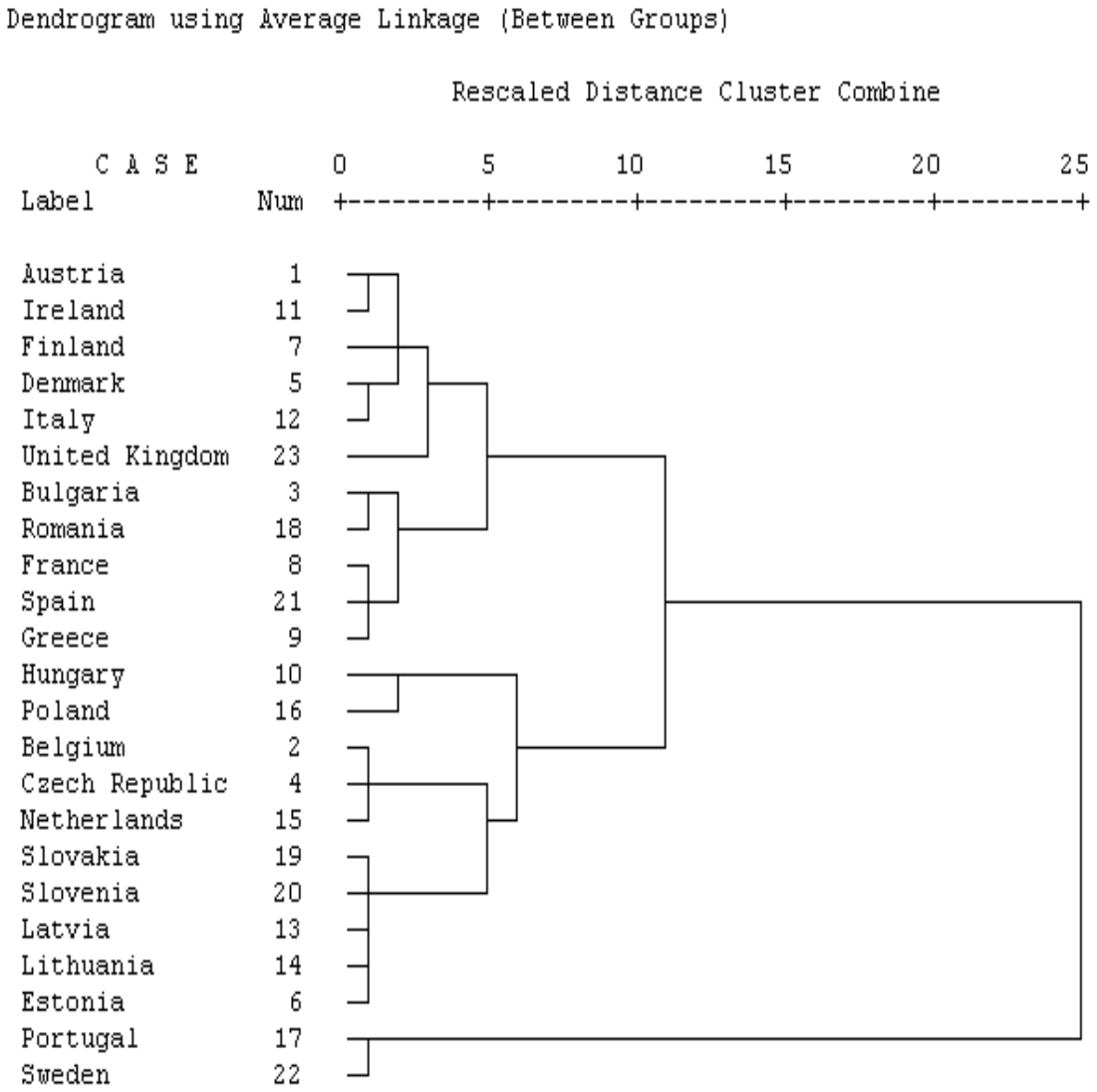
The challenge that the European Union countries face at the beginning of the 21st century is how to stop the female wave of the smoking epidemic, particularly in developed countries. There needs to be a wider recognition that women's tobacco use is a global health and demographic problem and that effective women-centred tobacco control programmes should be implemented at international as well as national levels. Unless there is a strong, coordinated effort with the aims of preventing girls and adolescents from starting to smoke, and of assisting cessation, the tobacco epidemic will take a terrible toll on women (Mackay and Amos 2007:129).

7.6. Hierarchical cluster analysis of mortality patterns caused by lung cancer

The increasing trends of lung cancer mortality and other forms of malignant neoplasms in various countries of the European Union continues to be quite an urgent problem in the context of the last two stages of the epidemiological transition. In order to identify mortality differentiation from lung cancer, we need to group the EU countries through a hierarchical cluster analysis.

This part is devoted to study mortality tendencies of the male and female population of the EU countries from lung cancer using hierarchical cluster analysis. The essence of hierarchical clustering is an organization of smaller clusters in large or breaking up large clusters into smaller ones. Interpretation of the clusters could be portrayed as a dendrogram. Results of hierarchical clustering are usually well represented as dendrogram which can accommodate a large amount of information in a relatively small space. Dendrogram describes the closeness of individual points and the clusters to each other, is a graphic sequence of the association (separation) clusters. It should be noted, that we are considering a horizontal tree diagram. The diagram starts with each object in the class (on the left side of the diagram). As these dendrograms indicat below, the horizontal axis represents the distance of group (in the vertical tree diagrams, the vertical axis represents the distance of unification). When the data have a clear "structure" in terms of clusters of objects that are similar to each other, then this structure is likely to be reflected in the hierarchical tree, by different branches. It is important to note, that according to the different clusters, we can determine what specific countries is the most prevailing or show significantly low level of mortality from lung cance.

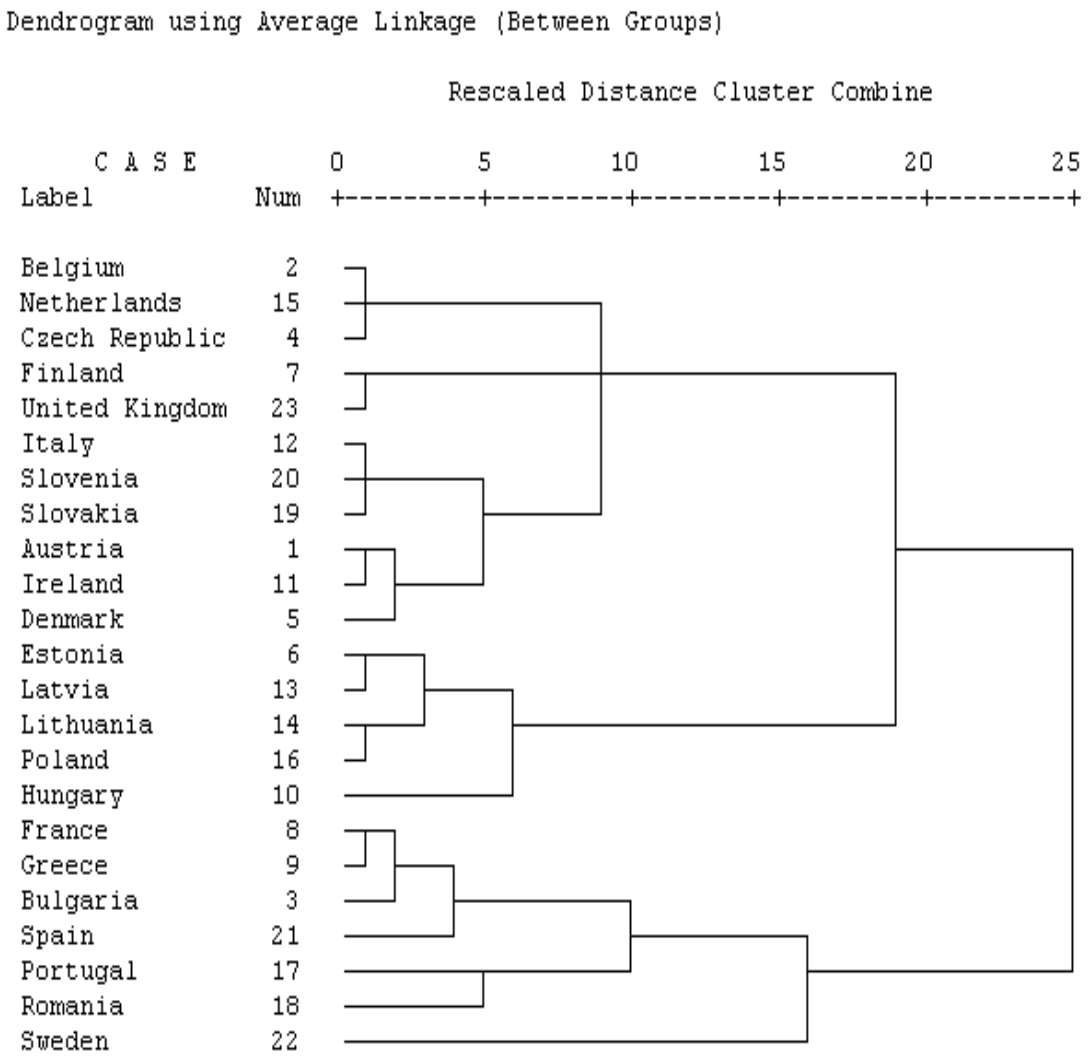
Fig 35*: Mortality caused by lung cancer, grouping of the EU countries in selected years, males*



Notes: Selected years (1980-1984; 1991-1995; 2002-2006)
Notes: Squared Euclidean distance, entry data transformed in Z-scores
Source: Author's calculations

The result of the grouping the countries in a cluster analysis can be clearly seen in Figure 35. Specifically, the selected countries are divided into two basic groups and three subgroups. The first group consists of two countries like Portugal and Sweden which indicated below. According to previous analysis, development of lung cancer mortality among males considered to be low in Sweden and Portugal. All other countries belong to the second main group. The countries like Hungary, Poland, Belgium, the Czech Republic, the Netherlands, Slovakia and Slovenia belong to subgroup which can be considered as countries with high mortality. The second major subgroup consists mainly of Western European countries like Austria, Ireland, Finland, Denmark, Italy, Britain, France, Spain and Greece. According to Subchapter 7.4, lung cancer mortality in these countries can be recorded as low.

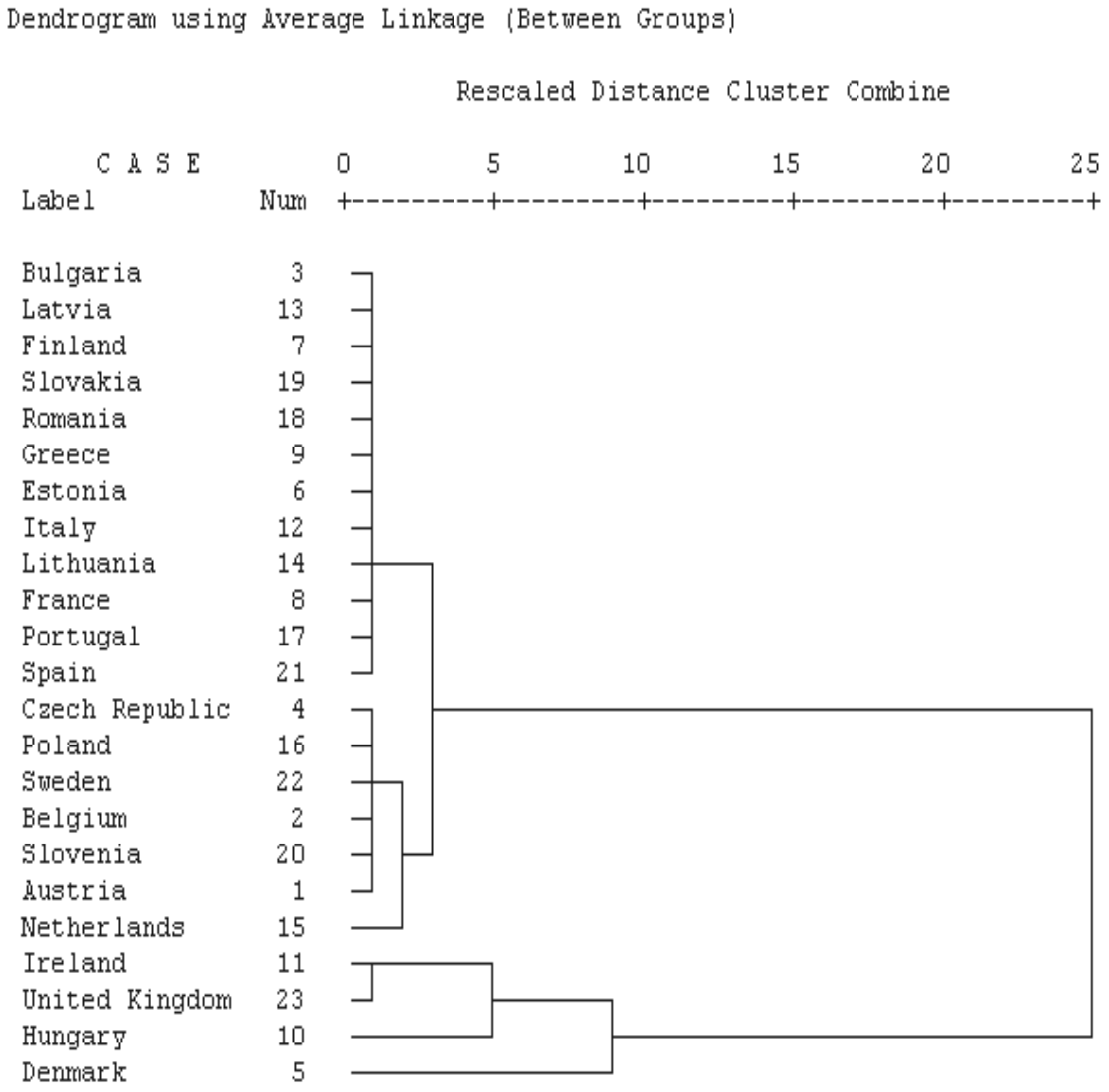
Fig 36*: Index of mortality changes caused by lung cancer, grouping of the EU countries in selected years, males*



Notes: Selected years (1980-1984; 1991-1995; 2002-2006)
Notes: Squared Euclidean distance, entry data transformed in Z-scores
Source: Author's calculations

Figure 36 allows us to identify two main groups and three subgroups. The first group consists of the majority of Western and post-communist European countries, in which male mortality from lung cancer can be considered as significantly high. In contrast to the first group, the second group consists of a small number of countries (France, Greece, Bulgaria, Spain, Portugal, Romania and Sweden) where mortality among men was significantly lower than in the first group. The first subgroup includes such countries as Belgium, the Netherlands, the Czech Republic, Finland, the United Kingdom, Italy, Slovenia, Slovakia, Austria, Ireland and Denmark. The second subgroup mainly consists of the former socialist European countries; in particular Hungary, Poland and the Baltic States. According to the Chapter 7.4, it can be assumed that lung cancer mortality was relatively high in both subgroups. From the above-mentioned analysis, it can be seen that the differentiation between the clusters is fairly obvious, because all the countries belonging to certain groups and subgroups showed significantly different patterns in mortality from lung cancer.

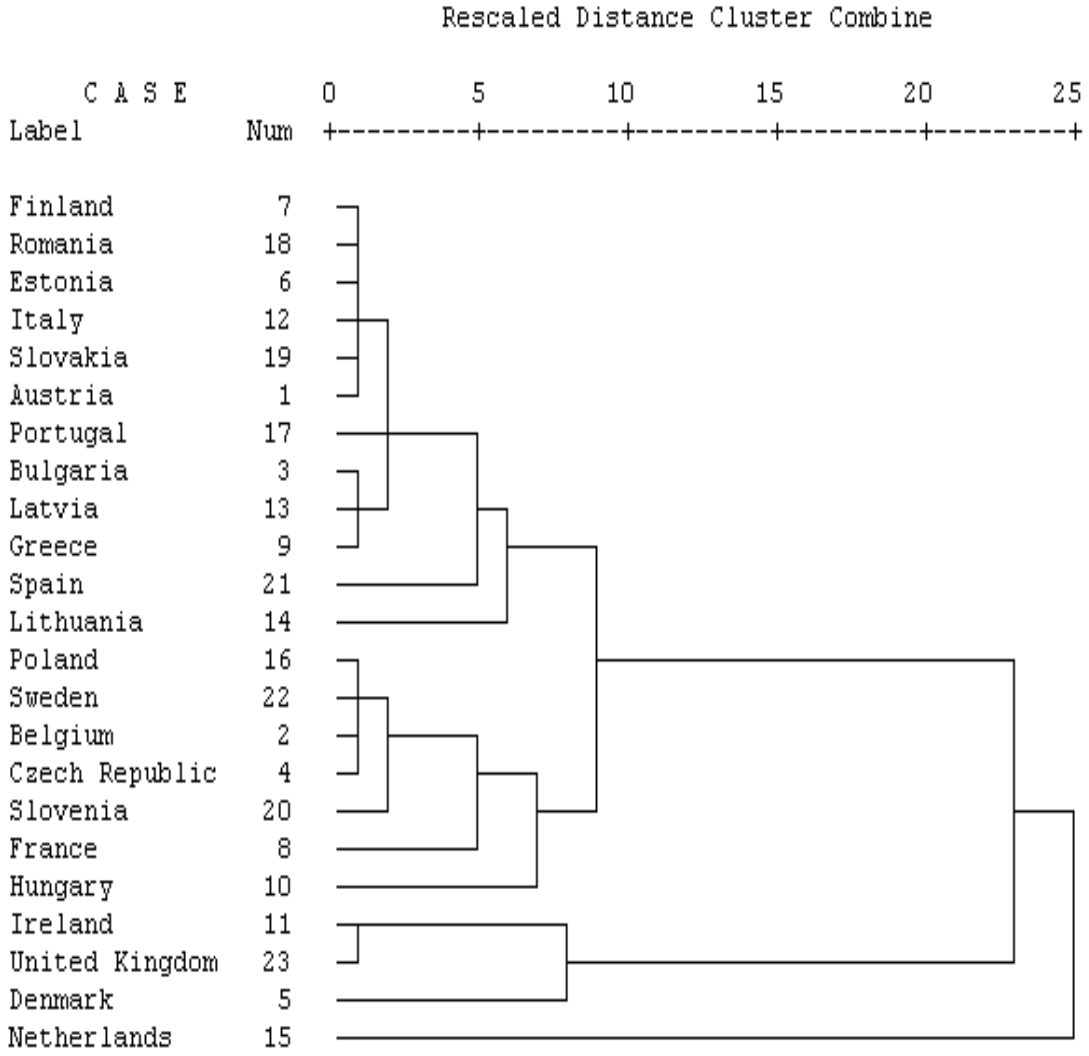
Fig 37*: Mortality caused by lung cancer, grouping of the EU countries in selected years, females*



Note: Selected years (1980-1984; 1991-1995; 2002-2006)
Note: Squared Euclidean distance, entry data transformed in Z-scores
Source: Author's calculations

In contrast to cluster indicators that were observed among men on the previous dendrograms, different and more homogeneous trends among women can be distinguished. All the countries of the European Unioncan can be divided in two basic groups and three small subgroups. Countries such as Denmark, Ireland, Hungary and the United Kingdom belong to the first group, in which lung cancer mortality among women can be considered extremely high, whereas, all other countries belong to the second group. One of the main subgroup consists mainly of those countries (for instance: Bulgaria, Romania, Finland, Slovakia, Greece, Italy, France, Portugal, Spain and the Baltic States) where female mortality was significantly low. The second subgroup may differ significantly from the previous one, mortality patterns from lung cancer among women in countries like the Czech Republic, Poland, Belgium, Slovenia, Austria and the Netherlands were relatively high.

Fig 38*: Index of mortality changes caused by lung cancer, grouping of the EU countries in selected years, females*



Note: Selected years (1980-1984; 1991-1995; 2002-2006)
Note: Squared Euclidean distance, entry data transformed in Z-scores
Source: Author's calculations

According to Figure 38, distinct differences between the two main groups of clusters were observed. The first group which is located at the bottom of this figure consists of four countries of Western Europe (Ireland, the United Kingdom, Denmark and the Netherlands) where mortality development from lung cancer remains the most unfavorable. All other countries belong to the second group of clusters, which were divided in two distinct subgroups. In the first subgroup there are five countries (Portugal, Bulgaria, Latvia, Greece, Spain, and Lithuania) where mortality patterns can be considered as intense and high. Poland, Sweden, Belgium, the Czech Republic, Slovenia, France and Hungary belong to the second major subgroup with substantially high mortality level.

Thus, using hierarchical cluster analysis, the EU countries were determined and grouped in terms of lung cancer mortality. It allows to differentiate certain groups of countries with high and low levels of mortality trends.

Conclusion

The analysis conducted in the Master Thesis covered 26 years (1980-2006) and presented the evidence of mortality development from lung cancer and other forms of malignant neoplasms in the European Union. The observed trends demonstrate that mortality trends still have substantial differences among most of the countries of the European Union. A comprehensive analysis of the part 7.1 indicates that mortality development within cardiovascular diseases still remains the most frequent and wide-spread disease in comparison to malignant neoplasms. During 1980 and 2006 mortality trends from circulatory diseases significantly changed in many countries. Particularly, in 1980s male mortality was extraordinary high in Estonia, Hungry, Latvia, Poland and the Czech Republic. Comparatively low tendencies were recorded in Spain, Sweden and France. In subsequent years mortality trends were gradually declining in many Western European countries, while mortality has remained relatively high in many Eastern European countries. At the end of the 1990 mortality development from malignant neoplasms began to increase in many Western European countries. Nowadays cancer becomes one of the frequent causes of death among the European population.

The part 7.2 allows to define mortality development from neoplasms among male and female population. Mortality trends from neoplasms were substantially homogeneous in Western Europe. Initially, most of the countries had an extremely high mortality rates, (France, the Netherlands and Belgium). From the second half of the 1990 mortality from neoplasms significantly declined in Western Europe. In the post-communist countries (For instance: Hungary, Slovakia and Baltic States) mortality was exceptionally high and intense. Initially, male mortality in Romania and Bulgaria was relatively low, but in subsequent years it was considered to be high. As for women, mortality trends in Western Europe were rather heterogeneous. Neoplasm was the common cause of death among Danish, Irish and British women. In post-communist countries female mortality from cancer was extremely high in Hungary and the Czech Republic, while in other countries mortality was less intense. Over the past decade mortality trends in Western Europe changed in a positive direction (especially among men), while in the former socialist countries it continues to be high. There are many reasons according to which, one can argue about positive and negative reasons that influenced the development of cancer mortality. Firstly, these favorable trends were achieved due to the improvement of social infrastructure, increasing economical liberty and rising living standards. Also the following could be mentioned: improvement in early detection of neoplasms (screening), adopted strategies on national levels. Secondly, many important circumstances such as geographical location, political regime, living conditions as well as nutrition cultures are responsible for the shape of

mortality due to mentioned causes of death within the European Union countries. Thus, in many post-communist countries of Europe (for example: Latvia, Lithuania, Estonia and Poland) mortality from neoplasms was very high and intense after the collapse and reformations that took place at the end of 1980^{s}.

Taking into account "supposed relation" between mortality and social stability within the concrete country, external exogenous factors that also play an important role must be taken into consideration. Industrial progress that has been emerging in most of European countries follows by pollution of air, all kinds of carcinogens that can negatively affect people's life. It can be noted that natural and man-made disasters can cause long-term effects for human beings. The striking examples of human catastrophes are the Chernobyl accident and a breakdown in Fukusima Nuclear Station in Japan. In general, not only exogenous factors continue to adversely affect on vital activity of the population in European countries, but also, society itself faces many problems that have been hidden in our behavior. Such behavioral factors as poor diet, sedentary lifestyle, addiction to drinking alcohol beverages and tobacco dependence has led to the fact that people are increasingly suffering from cancer. Thus, guided by serious arguments, it can be said that deaths caused by malignant neoplasms in many countries of the European Union continue to be heterogeneous. Among the most frequent forms of malignant neoplasms, lung cancer remains the most common. A progressive growth of lung cancer mortality was recorded almost in all EU countries. In the United Kingdom, the Netherlands, the Czech Republic, Belgium and Hungary mortality development from neoplasms remains extremely high. During the past few decades, mortality from breast cancer was unusually high among the European women. At the end of 20th century this situation changed. Lung cancer became the prevailing cause of death among females particularly in Denmark, Hungary and the United Kingdom.

According to the Subchapter 7.4 it can be said that mortality development from lung cancer was very distinctive between West and post-communist Europe. In 1980 West European countries faced a significant reduction from lung cancer mortality, while in post-communist Europe, mortality was considered to be high. From 1980 to 1987 the Netherlands and Belgium had the highest level of lung cancer mortality among men. Among the post-communist European countries Hungary had extremely high death rates. Mortality from lung cancer was substantially high in Poland, the Czech Republic and the Baltic States. One of the most favorable trends was recorded in France, Austria, Romania and Bulgaria, Sweden and Portugal. It is important to note that at the end of 1980 lung cancer mortality was gradually declining across West European countries, while in post-communist Europe mortality was increasing. In contrast to male trends, mortality development among women was substantially different. Throughout the entire period lung cancer mortality was very high in Denmark, the United Kingdom, Ireland, Hungary and the Netherlands. One of the most favorable developments of the lung cancer mortality was observed for Spanish, Portuguese, French and Lithuanian women. The possible reason for disparity in mortality patterns among European countries is the difference in tobacco consumption.

The chapter 7.5 illustrates that lung cancer mortality mostly affected elderly people. According to the obtained results, it can be said that most of the seniors began to die after the age of 45. The most common in terms of lung cancer mortality is the age group 65-74. From 1980 to 1990, mortality among seniors was significantly high in the United Kingdom, Belgium, the Netherlands, and the Czech Republic. In 2006 it started to increase in the Baltic countries, Poland and Hungary as well. It

should be noted that mortality trends from lung cancer are significantly different between men and women. In 1980 lung cancer mortality was most common in the age group 45-54, but in 1990 and 2006 it was observed to be high in the other age groups (for example 54-64, 65-74). Mortality among elderly women was extremely high in Denmark. Also, high mortality from lung cancer was recorded in the United Kingdom, Ireland, the Netherlands and Hungary.

According to the Chapter 6, it should be mentioned that there are many factors that may contribute to the emergence of lung cancer. It is important to note that lung cancer is related to domestic habits, environmental factors and lifestyle. Chemical and in particular radioactive substances such as radon and asbestos may have negative effect on lung tissue. Moreover, carcinogens as environmental and air pollution play their negative role in lung cancer emergence and development. All these factors are somehow connected with the external environment or occupational hazards. In contrast to the above-mentioned factors, tobacco smoking remains the most destructive and incredibly widespread habit. Currently, tobacco smoking is a major risk factor for lung cancer. In addition, there is the possibility of inheriting the defective gene that is a genetic predisposition to malignant tumors. For example, certain genes influence a person's ability to absorb some of the carcinogenic chemicals contained in tobacco smoke. If a person with an inherited sensitivity starts to smoke, it may increase the risk of developing lung cancer compared to other smokers. Taking into account all risk factors that were mentioned above, it must be emphasized that a behavioral factor plays a key role in the avoidance of negative consequences carcinogens and rehabilitation. As soon as people realize these negative factors, less people will suffer from this disease.

The obtained results allow to identify the countries with the highest level of cigarette consumption. According to gender differences described in Figures 1-2, it can be revealed that cigarette smoking among girls at age 15 was significantly high in Austria, Belgium, Latvia, Hungary and Germany. Among boys at the same age, smoking was most common in Austria, Spain, Finland, Denmark, Germany and the United Kingdom. Over the past two decades, cigarette smoking (among adult men and women) has substantially increased in many countries of the post-communist Europe (for example: Bulgaria, Hungary, Poland and the Baltic States), while in Western Europe smoking was gradually declining (for instance: Italy, France, Finland, Sweden and Portugal). It should be noted that by the end of the 1990s smoking prevalence was observed in Greece (the highest) as well in Spain and Slovenia. In contrast to Western European countries, where campaigns against tobacco smoking began earlier (e.g. increase of taxes, ban for advertising), tobacco products were much more accessible due to weak control for tobacco market and its cheapness and availability in the former socialist countries of Europe .

To conclude, it is difficult to predict the combined effect of mortality development from neoplasms in selected countries of the EU, because the trends differ so widely between countries according to age, sex and type of cancer. Undoubtedly, in particular countries of the European Union, for example Hungary, mortality from neoplasms still remains high for both sexes. However, it is important to emphasize, that many countries of the European Union (for instance: Belgium, the Czech Republic, Finland, France and the United Kingdom) have already made progress in their fight against cancer with more effective primary prevention, diagnosis and treatment. Effective implementation of further strategies in the future will help to limit the impact of many negative factors, in particular, strategies to reduce and offset tobacco consumption; effective screening for lung cancer;

mammography for breast and colorectal cancer, and adoption of the treatment that is proven to be effective and is accessible to all patients. It should be noted, that significance and priority for tobacco and cancer control can only be achieved with a high level of political support. In addition, a detailed analysis of the situation on the national level is a key step in implementing social policies against cancer. Scientists in the field of medicine and demography should facilitate further investigation of geographic and behavioral characteristics of diseases, mortality and survival for each of the most common types of neoplasm, by age and sex, and to establish priority areas for cancer control.

References

Adami, H. Day, N. Trichopoulos, D. and Willett W (2001). Primary and secondary prevention in the reduction of cancer morbidity and mortality. Department of Medical Epidemiology, Karolinska Instituted. Stocholm, Sweden: 118-127.

Ahmad, O.B. Boschi-Pinto, C. Lopez, A.D. Murray, C. Lozano, R. Inoue, M. (2001). Age standardization of rates. *A new WHO Standard:* World Health Organization: 1-12.

Albreht, T. McKee, M. Alexe, D. Coleman, M. and Martin-Moreno, J. (2008). Making progress against cancer in Europe in 2008. Institute of Public Health of the Republic of Slovenia, Trubarjeva 2, SI-1000 Ljubljana, Slovenia: 1451-1456.

Anderson, A. Armaroli, P. Baschung. B. Beck, V. Biedermann, A. Bosch, X. Cavalli, F. Defez, C. Domenighetti, G. Fogelholm, M. Franceschi, S. Lambert, R. Levi, F. Lynge, E. Maschewsky-Schneider, U. Merletti, F. Miller, A. Mirabelli, D. Mourouga, P. Muller, R. Pisani, P. Ribes, J. Sancho-Garnier, H. Lynge, E. Segnan, N. Slama, K. Somaini, B. and Stoebner-Delbarre A. (2004). Evidence based cancer prevention: strategies for NGOs. International Union against Cancer. Switzerland: International Union against Cancer.

Andreeva, T. and Krasovski, K. (2004). Tobacco and Health. Kiev: 1-224.

Blaine, T. and Michael, R. (1994). U.S. Cigarette Smoking and Health Warnings: New Evidences from Post World War II Data. USA: College of Agriculture and Life Sciences, Texas A & M University, College Station, Texas: 535-544.

Bofetta, P. and Nyberg, F. (2003). Contribution of environmental factors to cancer risk. International Agency for Research on Cancer: 71-94.

Boyle, P. Onofrio, A. Maisonneuve, P. Severi, G. Robertson, S. Tubiana, M. and Veronesi, U. (2003). Measuring progress against cancer in Europe: has the 15% decline targeted for 2000 come about. European Institute of Oncology, Milan, Italy; Institute Gustavo Roussy, Villejuif, France: 1312-1325.

Bray, F. Tyczynski, J., and Parkin, M. (2004). Going up or coming down? The changing phases of the lung cancer epidemic from 1967 to 1999 in the 15 European Union countries. International Agency for Research on Cancer: 96-125

Caselli, G. Mesle, F. and Vallin, J. (2004). Epidemiological transition theory exceptions. Italy: Department of Demographic science: 1-34.

Colley, J.R. Holland, W.W. and Corkhill, R.T. (1974). Influence of passive smoking and parental phlegm on pneumonia and bronchitis in early childhood. London, Department of Medical Statistics and Epidemiology, London School of Hygiene and Tropical Medicine: 1031 – 1034.

Commission of the European Communities (1999). Progress achieved in relation to public health protection from the harmful of tobacco consumption. [Electronic resource] http://ec.europa.eu/health/ph_determinants/life_style/Tobacco/Documents/comm407_en.pdf Brussel. http://aei.pitt.edu/5967/1/003154_1.pdf

Demoscope (2002). From deaths and its causes. . [Electronic resource] Institute of Demography of the State University - Higher School of Economics. http://www.demoscope.ru/weekly/2007/0311/analit02.php

Demoscope (2004). First and second epidemiological transition. [Electronic resource] Center for Demography and Human Ecology, Institute of Economic Forecasting of Russian Academy of Sciences.http://www.demoscope.ru http://demoscope.ru/weekly/2004/0145/tema01.phphttp://demoscope.ru/weekly/2004/0145/tema01.phphttp://demoscope.ru/weekly/2004/0145/tema01.php

Donaldson, S. L and Gilmore, I (2010). Passive smoking and children. Royal College of Physicians: 177-197.

Dostal, P. and Pokorny, P. (1991). Cluster analysis and Genetic Algorithms. Brno, University of Technology.

Gaylin, D. and Kates, J. (1997). Refocusing the lens: Epidemiologic transition theory, mortality differentials, and the AIDS Pandemic. Social Science & Medicine: 609-621.

Kardinal, C. and Yarbro, J. (1979). Conceptual History of Cancer. Seminars in Oncology: 396-408.

Khuri F.R. (2003). Primary and secondary prevention of non-small-cell lung cancer: the SPORE Trials of Lung Cancer Prevention. USA: Emory University, Winship Cancer Institute, Atlanta: 1:S36-40.

Mackay, J. and Amos, A. (2003). Women and Tobacco. Advisor, TFI, World Health Organization, Asian Consultancy on Tobacco Control, Hong Kong and Public Health Sciences, Department of Community Health Sciences, University of Edinburgh Medical School, Scotland, United Kingdom: 123-130.

Mohandas, K.M. (2001) Genetic predisposition to cancer. Division of Digestive Diseases and Clinical Nutrition: 482-489.

Multilingual demographic dictionary, (1958) Published by United Nations, Department of Economic and Social Affairs in New York.

Mesle, F. and Vallin, J. (2002). Mortality in Europe: the Divergence between East and West. Institute National Etudes Démographiques: 157-197.

Palmer, A.A. (1986). Christopher J. Duerksin, Environmental Regulation of Industrial Plant Siting. USA, 297-299.

Simonato, L. Agudo, A. Ahrens, W. Benhamou, E. Benhamou, S. Bofetta, P. Brennan, P. Darby, S. Forastiere, F. Fortes, C. Gaborieau, V. Gerken, M. Gonzales, C. Jockel, K. Kreuzer, M. Merletti, F. Nyberg, F. Pershagen, G. Pohlabeln, H. Rosch, F. Whitley, E. Wichmann, H., and Zabmon, P. (2001). Lung cancer and cigarette smoking in Europe: An update of risk estimates

and an assessment of inter-country heterogeneity. Publication of the International Union against Cancer: 876-887.

Tyczinski, J. Bray, F. Boffetta, Aareleid, T. Dalmas, M. Kurtinaitis, J. Plesco, I. Pompe-Kirn, V. Stengrevics, A., and Parkin, M. (2004). Lung cancer mortality patterns in selected Central, Eastern and Southern European countries. International Agency for Research on Cancer, Lyon, France: 598–610.

Vainio, H. Husgafvel-Pursiainen, K. Anttila S. Karjalainen, A. Hackman, P. and Partanen, T. (1993). Interaction between Smoking and Asbestos in Human Lung Adenocarcinoma: Role of K-*ras* Mutations. Environmental Health Perspectives Supplements, Vol. 101 (Suppl. 3): 189-192

Vishnevski A. (2005). Demographic theory and demographic history. Moscow: Publishing Science: 1-370.

Uglov F. (1959). Smoking and Lung cancer. Moscow: Publishing Knowledge, 1-32.

Zatonski, W. Didkowska, Y. (2008). Closing the gap: Cancer in Central and Eastern Europe (CEE). Division of Epidemiology and Cancer Prevention Centre, Marie Sklodowska-Curie Memorial Cancer Centre, 5, Roentgen Str., 02-781 Warsaw, Poland: 1425-1437.

WHO (2002). National Cancer Control Programmes. [Electronic resource] http://ncd.bvsalud.org/lildbi/docsonline/8/3/038-national_cancer_control_programmes_-_who.pdf

WHO (2002). European Strategy for Tobacco Control. [Electronic resource] Copenhagen, Denmark. http://www.euro.who.int/__data/assets/pdf_file/0008/68093/E75872R.pdf

WHO Report on the Global Tobacco Epidemic (2008). Fresh and Alive. [Electronic resource] http://whqlibdoc.who.int/publications/2009/9789241563918_eng_full.pdfhttp://www.who.int/tobacco/mpower/2008/en/index.html

WHO Report on the Global Tobacco Epidemic (2009). Implementing smoke free environments. [Electronic resource] http://www.who.int/tobacco/mpower/2009/en/index.html

WHO (2010). Women are huge potential market for the tobacco industry. [Electronic resource] http://www.euro.who.inCopenhagen.http://www.euro.who.int/en/what-we-publish/information-for-the media/sections/latest-press-releases/world-no-tobacco-day-may-31,-2010-women-are-huge-potential-market-for-the-tobacco-industry

WHO (2010). Asbestos: elimination of asbestos related diseases. [Electronic resource] http://www.who.int/mediacentre/factsheets/fs343/en/index.html http://www.who.int/mediacentre/factsheets/fs343/en/index.html

.

List of appendices

Annex 1	Index of mortality change, caused by all causes of death and neoplasms selected periods, males (per 100 000 persons, WHO European Population Standard)
Annex 2	Index of mortality change, caused by other causes of death and neoplasms, selected periods, males (per 100 000 persons, WHO European Population Standard)
Annex 3	Index of mortality change, caused by circulatory diseases and neoplasms, selected periods, males (per 100 000 persons, WHO European Population Standard)
Annex 4	Index of mortality change, caused by all causes of death and neoplasms, selected periods, females (per 100 000 persons, WHO European Population Standard)
Annex 5	Index of mortality change, caused by other causes of death and neoplasms, selected periods, females (per 100 000 persons, WHO European Population Standard)
Annex 6	Index of mortality change, caused by circulatory diseases and neoplasms, selected periods, females (per 100 000 persons, WHO European Population Standard)

`

Index of mortality change, caused by all causes of death and neoplasms, selected periods, males(per 100 000 persons, WHO Euopean Population Standard)

Countries	Males								
	All causes			Malignant neoplasms			Index neoplasms/all causes		
	1980	1990	2006	1980	1990	2006	1980/1980	1990/1990	2006/2006
Austria	1361.7	1080.06	748.0	288.8	271.9	212.3	21	25	55
Belgium*	1321.6	1070.92	829.5	324.3	307.6	235.3	25	29	63
Bulgaria	1456.2	1437.09	1353.2	173.3	196.8	224.5	12	14	93
Czech Republic	1645.5	1606.43	1031.5	336.2	358.7	284.2	20	22	63
Denmark	1260.1	1118.31	830.8	277.4	278.7	245.5	22	25	66
Estonia*	1815.5	1698.86	1463.7	270.3	286.1	302.1	15	17	81
Finland	1405.1	1201.30	817.1	273.5	237.7	183.9	19	20	58
France	1179.2	957.27	719.7	306.8	305.0	242.6	26	32	61
Germany*	…	1132.3	747.9	…	275.6	210.9	…	24	…
Greece	1019.9	897.55	731.7	205.1	215.5	207.4	20	24	72
Hungary	1767.6	1710.9	1383.9	317.3	372.9	330.9	18	22	78
Ireland	1415.2	1218.5	756.9	253.7	269.7	218.7	18	22	53
Italy	1204.3	980.8	672.0	274.0	291.3	223.5	23	30	56
Latvia	1728.2	1712.10	1617.8	247.5	288.1	299.4	14	17	94
Lithuania*	1504.8	1466.72	1595.3	244.3	283.0	299.5	16	19	106
Netherlands	1098.3	1017.51	741.6	311.7	301.2	234.6	28	30	68
Poland	1725.9	1586.28	1168.2	265.1	299.5	293.6	15	19	68
Portugal*	1565.3	1210.66	874.7	212.2	217.1	216.2	14	18	56
Romania	1484.5	1393.65	1292.1	191.8	190.0	240.8	13	14	87
Slovakia	…	1430.8	1286.9	265.7	314.0	301.5	…	22	…
Slovenia	1477.3	1294.52	927.0	300.5	294.6	277.4	20	23	63
Spain	1090.1	973.86	755.5	222.3	261.1	232.8	20	27	69
Sweden	1076.4	922.37	669.1	197.9	199.5	178.3	18	22	62
United Kingdom	1321.0	1057.34	732.7	287.0	278.7	215.6	22	26	55

Sourse: Own calculation

Index of mortality change, caused by other causes of death and neoplasms, selected periods, males (per 100.000 persons WHO Euopean Population Standard)

Countries	Males								
	Other causes			Malignant neoplasms			Index neoplasms/other causes		
	1980	1990	2006	1980	1990	2006	1980/1980	1990/1990	2006/2006
Austria	434.8	315.29	257.5	288.8	271.9	212.3	66	86	59
Belgium*	471.9	399.0	336.6	324.3	307.6	235.3	69	77	71
Bulgaria	567.0	427.4	307.0	173.3	196.8	224.5	31	46	54
Czech Republic	443.3	410.8	269.4	336.2	358.7	284.2	76	87	61
Denmark	448.1	391.2	341.5	277.4	278.7	245.5	62	71	76
Estonia*	560.9	486.1	472.9	270.3	286.1	302.1	48	59	84
Finland	455.8	395.1	315.9	273.5	237.7	183.9	60	60	69
France	490.5	385.0	302.8	306.8	305.0	242.6	63	79	62
Germany*	…	346.3	244.7	…	275.6	210.9	…	80	…
Greece	411.4	266.4	214.1	205.1	215.5	207.4	50	81	52
Hungary	607.0	531.7	409.1	317.3	372.9	330.9	52	70	67
Ireland	456.5	401.5	269.7	253.7	269.7	218.7	56	67	59
Italy	413.6	315.2	223.1	274.0	291.3	223.5	66	92	54
Latvia	540.3	545.17	539.3	247.5	288.1	299.4	46	53	100
Lithuania*	583.6	445.25	555.2	244.3	283.0	299.5	42	64	95
Netherlands	313.1	325.4	284.9	311.7	301.2	234.6	100	93	91
Poland	723.0	518.7	394.3	265.1	299.5	293.6	37	58	55
Portugal*	786.0	522.7	387.4	212.2	217.1	216.2	27	42	49
Romania	466.9	428.5	324.3	191.8	190.0	240.8	41	44	69
Slovakia	…	454.6	350.5	265.7	314.0	301.5	…	69	…
Slovenia	513.8	442.6	327.6	300.5	294.6	277.4	58	67	64
Spain	422.6	375.69	314.1	222.3	261.1	232.8	53	69	74
Sweden	310.2	272.0	228.9	197.9	199.5	178.3	64	73	74
United Kingdom	414.1	303.8	270.9	287.0	278.7	215.6	69	92	65

Sourse: Own calculation

Index of mortality change, caused by circulatory diseases abd neoplasms, selected periods, males (per 100 000 persons, WHO Euopean Population Standard)

Countries	Males								
	Circulatory diseases			Malignant neoplasms			Index neoplasms /circulatory diseases		
	1980	1990	2006	1980	1990	2006	1980/1980	1990/1990	2006/2006
Austria	638.1	492.9	278.2	288.8	271.9	212.3	45	55	44
Belgium*	525.4	364.4	257.5	324.3	307.6	235.3	62	84	49
Bulgaria	715.8	813.0	821.8	173.3	196.8	224.5	24	24	115
Czech Republic	819.1	834.2	477.8	336.2	358.7	284.2	41	43	58
Denmark	555.0	472.8	243.8	277.4	278.7	245.5	50	59	44
Estonia*	984.3	926.6	688.8	270.3	286.1	302.1	27	31	70
Finland	696.2	563.3	317.2	273.5	237.7	183.9	39	42	46
France	381.8	267.3	174.3	306.8	305.0	242.6	80	114	46
Germany*	…	510.4	292.3	…	275.6	210.9	…	54	…
Greece	403.4	415.7	310.1	205.1	215.5	207.4	51	52	77
Hungary	843.3	806.3	590.7	317.3	372.9	330.9	38	46	70
Ireland	705.1	547.2	265.5	253.7	269.7	218.7	36	49	38
Italy	516.7	374.4	225.4	274.0	291.3	223.5	53	78	44
Latvia	940.5	878.8	779.2	247.5	288.1	299.4	26	33	83
Lithuania*	677.0	738.5	740.6	244.3	283.0	299.5	36	38	109
Netherlands	473.5	391.0	222.1	311.7	301.2	234.6	66	77	47
Poland	737.9	768.1	480.2	265.1	299.5	293.6	36	39	65
Portugal*	567.1	466.9	271.1	212.2	217.1	216.2	37	46	48
Romania	825.7	775.2	726.9	191.8	190.0	240.8	23	25	88
Slovakia	742.6	774.0	634.9	265.7	314.0	301.5	…	41	…
Slovenia	663.0	557.4	322.0	300.5	294.6	277.4	45	53	49
Spain	445.1	337.1	208.7	222.3	261.1	232.8	50	77	47
Sweden	568.2	446.0	261.9	197.9	199.5	178.3	35	45	46
United Kingdom	619.9	474.8	246.2	287.0	278.7	215.6	46	59	40

Sourse: Own calculation

Index of mortality change, caused by all causes of death and neoplasms, selected periods, females (per 100 000 persons, WHO Euopean Population Standard)

Countries	Females								
	All causes			Malignant neoplasms			Index neoplasms/all causes		
	1980	1990	2006	1980	1990	2006	1980/1980	1990/1990	2006/2006
Austria	821.9	643.40	459.7	176.4	164.4	127.5	21	26	56
Belgium*	782.4	606.07	501.9	169.8	155.4	130.8	22	26	64
Bulgaria	1010.7	740.53	815.1	111.8	117.1	124.2	11	16	81
Czech Republic	966.4	897.7	615.0	180.9	191.8	163.2	19	21	64
Denmark	729.3	702.51	568.1	188.0	201.4	182.1	26	29	78
Estonia*	940.6	885.29	669.4	139.2	143.7	143.4	15	16	71
Finland	724.5	651.2	447.5	140.8	136.9	113.4	19	21	62
France	624.9	496.35	377.2	142.7	133.6	112.2	23	27	60
Germany*	…	673.3	477.2	…	165.0	131.9	…	25	…
Greece	735.6	618.89	518.0	117.1	113.3	111.0	16	18	70
Hungary	1061.1	967.22	757.7	191.7	197.3	172.7	18	20	71
Ireland	918.8	738.5	504.9	185.4	182.9	159.8	20	25	55
Italy	716.5	568.43	402.8	145.7	148.2	122.6	20	26	56
Latvia	924.8	899.14	787.2	134.6	142.3	145.5	15	16	85
Lithuania*	820.7	785.6	749.4	130.0	138.4	133.4	16	18	91
Netherlands	618.3	576.1	496.0	163.1	165.8	154.3	26	29	80
Poland	939.0	851.77	611.5	153.4	156.0	154.9	16	18	65
Portugal*	950.7	735.7	515.2	128.7	129.1	110.8	14	18	54
Romania	1113.6	974.0	808.3	124.1	117.6	132.6	11	12	73
Slovakia	…	780.5	714.1	144.3	148.5	145.7	…	19	…
Slovenia	822.0	715.80	503.9	156.8	155.4	145.4	19	22	61
Spain	669.0	561.4	420.9	120.3	123.6	103.3	18	22	63
Sweden	647.3	563.4	452.7	159.6	144.2	135.3	25	26	70
United Kingdom	789.8	662.5	510.5	183.7	187.7	153.7	23	28	65

Sourse: Own calculation

Index of mortality change, caused by circulatory diseases abd neoplasms, selected periods, females (per 100 000 persons, WHO Euopean Population Standard)

Countries	Females								
	Circulatory diseases			Malignant neoplasms			Index neoplasms/circulatory diseases		
	1980	1990	2006	1980	1990	2006	1980/1980	1990/1990	2006/2006
Austria	434.2	321.4	192.5	176.4	164.4	127.5	41	51	44
Belgium*	330.7	227.4	168.7	169.8	155.4	130.8	51	68	51
Bulgaria	567.7	586.4	540.8	111.8	117.1	124.2	20	20	95
Czech Republic	549.2	512.6	318.2	180.9	191.8	163.2	33	37	58
Denmark	315.9	280.3	154.4	188.0	201.4	182.1	59	72	49
Estonia*	611.3	557.8	360.3	139.2	143.7	143.4	23	26	59
Finland	383.3	311.8	171.3	140.8	136.9	113.4	37	44	45
France	230.4	159.3	102.1	142.7	133.6	112.2	62	84	44
Germany*		326.9	201.8	…	165.0	131.9	…	50	…
Greece	327.0	329.9	259.3	117.1	113.3	111.0	36	34	79
Hungary	574.0	524.5	401.4	191.7	197.3	172.7	33	38	70
Ireland	451.7	318.6	159.6	185.4	182.9	159.8	41	57	35
Italy	354.4	249.5	151.0	145.7	148.2	122.6	41	59	43
Latvia	608.6	543.2	421.1	134.6	142.3	145.5	22	26	69
Lithuania*	492.1	483.4	439.8	130.0	138.4	133.4	26	29	89
Netherlands	618.3	217.1	138.6	163.1	165.8	154.3	26	76	22
Poland	463.8	462.2	291.9	153.4	156.0	154.9	33	34	63
Portugal*	418.5	337.7	194.1	128.7	129.1	110.8	31	38	46
Romania	719.3	645.1	531.0	124.1	117.6	132.6	17	18	74
Slovakia	518.6	479.3	417.5	144.3	148.5	145.7	…	31	…
Slovenia	444.1	371.4	212.5	156.8	155.4	145.4	35	42	48
Spain	325.7	246.1	139.7	120.3	123.6	103.3	37	50	43
Sweden	323.8	255.8	162.9	159.6	144.2	135.3	49	56	50
United Kingdom	366.9	281.4	155.9	183.7	187.7	153.7	50	67	42

Sourse: Own calculation

Index of mortality change, caused by other causes of death and neoplasms, selected periods, females (per 100 000 persons, WHO Euopean Population Standard)

Countries	Females								
	Other causes			Malignant neoplasms			Index neoplasms/other causes		
	1980	1990	2006	1980	1990	2006	1980/1980	1990/1990	2006/2006
Austria	211.3	157.7	139.7	176.4	164.4	127.5	83	104	66
Belgium*	281.9	223.23	202.5	169.8	155.4	130.8	60	70	72
Bulgaria	331.2	227.0	150.1	111.8	117.1	124.2	34	52	45
Czech Republic	226.3	193.4	133.7	180.9	191.8	163.2	80	99	59
Denmark	225.4	234.3	231.6	188.0	201.4	182.1	83	86	103
Estonia*	190.1	183.8	165.7	139.2	143.7	143.4	73	78	87
Finland	213.9	198.1	162.8	140.8	136.9	113.4	66	69	76
France	251.9	203.5	162.9	142.7	133.6	112.2	57	66	65
Germany*		181.4	143.5	…	165.0	131.9	…	91	…
Greece	291.5	175.73	147.7	117.1	113.3	111.0	40	64	51
Hungary	295.3	245.40	183.6	191.7	197.3	172.7	65	80	62
Ireland	281.7	237.0	185.5	185.4	182.9	159.8	66	77	66
Italy	216.3	170.8	129.2	145.7	148.2	122.6	67	87	60
Latvia	181.6	213.7	220.5	134.6	142.3	145.5	74	67	121
Lithuania*	198.6	163.8	176.1	130.0	138.4	133.4	65	84	89
Netherlands	185.3	193.2	203.1	163.1	165.8	154.3	88	86	110
Poland	321.7	233.59	164.7	153.4	156.0	154.9	48	67	51
Portugal*	403.5	268.8	210.3	128.7	129.1	110.8	32	48	52
Romania	270.2	211.3	144.8	124.1	117.6	132.6	46	56	54
Slovakia	…	212.0	151.0	144.3	148.5	145.7	…	70	…
Slovenia	221.2	188.9	146.0	156.8	155.4	145.4	71	82	66
Spain	223.0	191.7	177.8	120.3	123.6	103.3	54	64	80
Sweden	178.4	159.4	154.6	159.6	144.2	135.3	89	91	87
United Kingdom	239.2	193.4	200.9	183.7	187.7	153.7	77	97	84

Sourse: Own calculation